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ABSTRACTS

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ABBREVIATED TITLES USED IN THE ABSTRACTS.

Abbreviated Title.	*Journal.*
A.S.T.M. Bull.	Bulletin of the American Society for Testing Materials.
Aero. Engng Review	Aeronautical Engineering Review.
Aeroplane	Aeroplane.
Aircr. Engng	Aircraft Engineering.
Aircr. Prod.	Aircraft Production.
Aircr. Prod. Analyst	Aircraft Production Analyst.
Amer. Dyestuff Rept.	American Dyestuff Reporter.
Anal. Chem.	Analytical Chemistry.
Annals appl. Biology	Annals of Applied Biology.
Ann. des Mines et des Carburants	Annales des Mines et des Carburants.
Ann. Min. Belg.	Annales des Mines de Belgique.
Ann. Min. Roumanie	Annales des Mines de Roumanie.
Ann. Off. Combust. liq.	Annales de l'Office National des Combustibles Liquides.
Asph. u. Teer	Asphalt und Teer.
Auto Engr	Automobile Engineer.
Auto. Ind.	Automotive Industries.
Auto. Tech. Z. (Berlin)	Automobiltechnische Zeitschrift (Berlin).
Azerb. neft. Khoz.	Azerbaidzhaniskoe Neftyanoe Khozyaistvo.
Beitr. angew. Geophys.	Beitrage angewandte Geophysik.
Beitr. Geophys.	Beitrage zur Geophysik.
Bitumen	Bitumen.
Bol. del Inst. Sudamericano del Petroleo	Boletin del Instituto Sudamericano del Petroleo.
Bol. Geol. y Min. (Caracas)	Boletin de Geologia y Mineria (Caracas).
Bol. Inform. Petroleras (B.A.)	Boletin de Informaciones Petroleras (Buenos Aires).
Boll. Soc. geol. ital.	Bolletin de la Societa Geologica Italiana.
B.P.	British Patent.
Brit. Med. J.	British Medical Journal.
Brit. Petrol. Equip. News	British Petroleum Equipment News.
Brit. Plastics	British Plastics.
Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.	Bulletin of the Academy of Science, U.S.S.R., Division of Technology and Science.
Bull. Acad. Sci. U.S.S.R., Inst. Seismol.	Bulletin of the Academy of Sciences U.S.S.R., Institute of Seismology.
Bull. Amer. Ass. Petrol. Geol.	Bulletin of the American Association of Petroleum Geologists.
Bull. Amer. geol. Soc.	Bulletin of the American Geological Society.
Bull. Ass. franç. Tech. Pétrole	Bulletin de l'Association Français des Techniciens du Pétrole.
Bull. Inst. Min. & Met.	Bulletin of the Institute of Mining and Metallurgy.
Bull. Inst. Min. (metall.) Engrs	Bulletin of the American Institute of Mining and Metallurgical Engineers.
Bull. Inst. Nat. Recherches Tech. Roum.	Bulletin de l'Institut Nationale des Recherches Technique de Roumanie.
Bull. Math. Phys. Éc. polyt. Bucharest	Bulletin de Mathematique et de Physique, Bucharest (École-polytechnique).
Bull. roum. geol. Soc.	Bulletin of the Roumanian Geological Society.
Bull. seismol. Soc. Amer.	Bulletin of the Seismological Society of America.
Bull. Soc. des Naturalistes de Moscou	Bulletin de Société des Naturalistes de Moscou.
Bur. Stand. J. Res., Wash.	United States Bureau of Standards Journal of Research, Washington.
Bull. Univ. Texas (Bur. econ. Geol. Techn.)	Bulletin of the University of Texas (Bureau of Economic Geology and Technology).
Calif. Oil World	California Oil World.
Canad. Chem. & Proc. Industr.	Canadian Chemical and Process Industries.
Canad. J. Res.	Canadian Journal of Research.
Canad. Min. J.	Canadian Mining Journal.
Canad. Min. metall. Bull.	Bulletin of the Canadian Institute of Mining and Metallurgy.
Chem. & Ind.	Chemistry and Industry.
Chem. Engng	Chemical Engineering.
Chem. Eng. News	Chemical and Engineering News.

Abbreviated Title.	*Journal.*
Chem. Engng Prog.	Chemical Engineering Progress.
Chem. Ind.	Chemical Industries.
Chem. Met. Engng	Chemical and Metallurgical Engineering.
Chem. Prod.	Chemical Products.
Chem. Rev.	Chemical Reviews.
Chem. Tr. J.	Chemical Trade Journal.
Chem. Wkbld.	Chemische Weekblad.
Chim. Anal.	Chimie Analytique.
Chim. e Industria	La Chimica e l'Industria.
Chim. et Ind.	Chimie et Industrie.
Coke and Gas	Coke and Gas.
C.R. Acad. Sci. (Paris).	Comptes Rendus hebdomadaires des Seances de l'Academie des Sciences (Paris).
C.R. Geol. Pétr. (Strasbourg)	Comptes Rendus des Seances du Groupe des Geologues Pétroliers de Strasbourg.
Diesel Eng. Us. Ass.	Diesel Engine Users Association.
Diesel Pwr Diesel Transportation	Diesel Power and Diesel Transportation.
Direccion Minas y Geol.	Publication of Direccion Minas y Geologicas (Argentine).
Doklad. Akad. Nauk S.S.S.R.	Dokladui Akademii Nauk S.S.S.R.
Econ. Geol.	Economic Geology.
Electr. Times	Electrical Times.
Engineer	Engineer.
Engineering	Engineering.
Erdöl u. Kohle	Erdöl und Kohle.
Flight	Flight
Fuel	Fuel in Science and Practice.
Fuel Oil & Oil Heat	Fuel Oil and Oil Heat.
Gas Oil Pwr	Gas and Oil Power.
Geol. Mag. (Lond.)	Geological Magazine (London).
Geophys.	Geophysics.
Glückauf	Glückauf.
Groz. Neft.	Groznenskii Neftyanik.
Heating Ventilating Engr	Heating and Ventilating Engineer and Journal of Air Conditioning.
India Rubber J.	India Rubber Journal.
India Rubber World	India Rubber World.
Ind. Min. (Argentina)	Industria Minera (Argentina).
Industr. Chem.	Industrial Chemist.
Industr. Engng Chem.	Industrial and Engineering Chemistry.
Industr. Pwr & Fuel Econ.	Industrial Power and The Fuel Economist.
Inf. y Mem. Ing. (Peru)	Informaciones y Memorias de la Sociedad de Ingenieros del Peru.
Ingenieur	De Ingenieur.
Instrum. Prac.	Instrument Practice.
Instruments	Instruments.
I.P. Review	Institute of Petroleum Review.
J. Aero. Sci.	Journal of Aeronautical Sciences.
J. Amer. chem. Soc.	Journal of the American Chemical Society.
J. appl. Chem. (U.S.S.R.)	Journal of Applied Chemistry, U.S.S.R.
J. appl. Mech.	Journal of Applied Mechanics.
J. appl. Phys.	Journal of Applied Physics.
J. chem. Education	Journal of Chemical Education.
J. chem., metall. min. Soc. S. Africa	Journal of the Chemical, Metallurgical and Mining Society of South Africa.
J. chem. Phys.	Journal of Chemical Physics.
J. chem. Soc.	Journal of the Chemical Society.
J. Coll. Sci.	Journal of Colloidal Science.
J. Council for Sci. & Ind. Res. (Australia)	Journal of the Council for Scientific and Industrial Research, Australia.
J. Econ. Ent.	Journal of Economic Entomology.
J. Geol.	Journal of Geology.
J. Inst. Fuel	Journal of the Institute of Fuel.
J. Instn auto. Engrs.	Journal of the Institution of Automobile Engineers.
J. Inst. Metals	Journals of the Institute of Metals.

Abbreviated Title.	*Journal.*
J. Inst. Petrol.	Journal of the Institute of Petroleum.
J. Iron & Steel Inst.	Journal of the Iron and Steel Institute.
J. Oil Col. Chem. Assoc.	Journal of the Oil & Colour Chemists Association.
J. org. Chem.	Journal of Organic Chemistry.
J. phys. & colloid Chem.	Journal of Physical and Colloidal Chemistry.
J. phys. Chem.	Journal of Physical Chemistry.
J. R. aero. Soc.	Journal of the Royal Aeronautical Society.
J. Roy. Soc. Arts.	Journal of the Royal Society of Arts.
J. sci. Instrum.	Journal of Scientific Instruments.
J. Soc. aut. Engrs	Journal of the Society of Automotive Engineers.
J. Soc. chem. Ind.	Journal of the Society of Chemical Industry.
J. Soc. Dyers Colourists	Journal of the Society of Dyers and Colourists.
J. Western Soc. Engrs	Journal of Western Society of Engineers.
Khim. Tverd. Topliva	Khimiya Tverdovo Topliva.
Lubr. Engng	Lubrication Engineering.
Matières grasses	Matières Grasses.
Mech. World	Mechanical World.
Min. & Metall.	Mining and Metallurgy.
Min. Mag. (Lond.)	Mining Magazine (London).
Mod. Plastics	Modern Plastics.
Monit. Pétr. roum.	Moniteur du Pétrole Roumain.
Montan. Rdsch.	Montanistische Rundschau.
Motor Ship.	Motor Ship.
N.G.A.A.	Natural Gasoline Association of America.
Nafta	Nafta.
Nat. Petrol. News	National Petroleum News.
Nat. Petrol. News, Tech. Sect.	National Petroleum News, Technical Section.
Nature	Nature.
Neft. Khoz.	Neftyanoe Khozyaistvo.
Nickel Ind.	Nickel Industry.
Nov. Neft.	Novosti Neftepererabotki.
Nov. Tekhn. Bur.	Novosti Tekhniki Bureniya.
Nov. Tekhn. Neft.	Novosti Tekhniki Neftedobvicki.
Oil Engine & Gas Turbine	Oil Engine and Gas Turbine.
Oil Gas J.	Oil and Gas Journal.
Oil Wkly	Oil Weekly.
Ole, Fette. Wachse	Ole, Fette, Wachse, Siefe, Kosmetik.
Olii min.	Olii Minerali.
Paint Mnfr.	Paint Manufacture.
Paint Technol.	Paint Technology.
Petroleum	Petroleum.
Petrol. Engr	Petroleum Engineer.
Petrol. Press Service	Petroleum Press Service.
Petrol. Process.	Petroleum Processing.
Petrol. Tech. (A.I.M.M.E.)	Petroleum Technology (American Institute of Mining and Metallurgical Engineers).
Petrol. Times	Petroleum Times
Petrol. World	Petroleum World.
Phil. Mag.	Philosophical Magazine.
Physics	Physics.
Pipe Line News	Pipe Line News.
Proc. Amer. Petrol. Inst.	Proceedings of the American Petroleum Institute.
Proc. Amer. Soc. Test. Mater.	Proceedings of the American Society for Testing Materials.
Proc. Ass. Asph. Pav. Technol.	Proceedings of the Association of Asphalt Paving Technologists.
Proc. Instn mech. Engrs	Proceedings of the Institution of Mechanical Engineers.
Proc. phys. Soc. (Lond.)	Proceedings of the Physical Society (London).
Proc. Roy. Soc.	Proceedings of the Royal Society.
Producers' Monthly	Producers' Monthly.
Przeg. Chem.	Przeglad Chemiczny.
Przem. Naft.	Przemysl Naftowy.
Public Roads	Public Roads.
Quart. J. geol. Soc. Lond.	Quarterly Journal of the Geological Society of London.
Rds & Rd Constr.	Roads and Road Construction.

Abbreviated Title.	*Journal.*
Rds and Streets	Roads and Streets.
Rec. Trav. chim. Pays-Bas	Recueil des Travaux Chimiques des Pays-Bas.
Refiner	Petroleum Refiner.
Rev. Inst. franç. Pétrole	Revue de L'Institut Français du Pétrole et Annales des Combustibles Liquides.
Rev. Mod. Phys.	Review of Modern Physics.
Rev. sci. Instrum.	Review of Scientific Instruments.
Ricerca Scientifica e Reconstruzione	Ricerca Scientifica e Reconstruzione.
Riv. ital. Petrol.	La Rivista Italiana del Petroleo.
Riv. Combustibile	La Rivista del Combustibile.
Roy. Engrs J.	Royal Engineers Journal.
S. Afr. Min. (Engng) J.	South African Mining and Engineering Journal.
Schweiz Arch. Ang. Wiss. Tech.	Schweizer Archiv für Angewandte Wissenschaft und Technik.
Science	Science.
Scientific Lubrication	Scientific Lubrication.
Soap	Soap.
Strade	Strade.
Sulz. tech. Rev.	Sulzer Technical Review.
Summ. Ops, Calif. Oil Flds	Summary of Operations, Californian Oil Fields.
Tech. Phys. U.S.S.R.	Technical Physics of the U.S.S.R.
Tekn. Tidskr.	Teknisk Tidskrift.
Terr. Magn.	Terrestrial Magnetism.
Times Rev. Ind.	Times Review of Industry.
Times Trade & Engng	Times Trade & Engineering Supplement.
Trans. Amer. Inst. Min. & Metall.	Transactions of the American Institute of Mining and Metallurgy.
Trans. Amer. geophys. Un.	Transactions of the American Geophysical Union.
Trans. Amer. Inst. chem. Engrs	Transactions of the American Institute of Chemical Engineers.
Trans. Amer. Soc. mech. Engrs	Transactions of the American Society of Mechanical Engineers.
Trans. Faraday Soc.	Transactions of the Faraday Society.
Trans. Inst. mar. Engrs	Transactions of the Institute of Marine Engineers.
Trans. Instn min. Engrs	Transactions of the Institution of Mining Engineers.
U.S. Bur. Mines, Inf. Circ.	United States Bureau of Mines, Information Circular.
U.S. Bur. Mines, Rep. Invest.	United States Bureau of Mines, Report of Investigations.
U.S. Bur. Mines, Tech. Paper	United States Bureau of Mines, Technical Paper.
U.S. Geol. Surv. Bull.	United States Geological Survey Bulletin.
U.S.P.	United States Patent.
World Oil	World Oil.
World Petrol.	World Petroleum.
Z. dtsch. geol. Ges.	Zeitschrift der Deutschen Geologischen Gesellschaft.
Z. Geophys.	Zeitschrift für Geophysik.
Z. prakt. Geol.	Zeitschrift zur Praktische Geologie.
Z. ver. dtsch. Chem.	Zeitschrift Vereins deutscher Chemiker.

(Certain periodicals listed above have not been available during 1949.)

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Oilfield Exploration and Exploitation.

Geology.

1. Tectonic Control of Lithologic Associations. E. C. Dapples, W. C. Krumbein, and L. L. Sloss. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1924–1947.—The writers suggest that lithologic responses to tectonic controls permit the organization of sediments into groups, depending on their mode of accumulation. Each lithologic association includes particular strata, which in the aggregate are the result of the tectonic framework, the tectonic intensity, and the nature of the depositional environment. Typical lithological associations are defined, and an attempt is made to collate the criteria by which they may be recognized. Examples are given from regional studies, and a table is presented of associated rock types set within their tectonic framework.
E. N. T.

2. Lithofacies Maps and Regional Sedimentary-Stratigraphic Analysis. W. C. Krumbein. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1909–1923.—This paper describes a statistical approach to the preparation of lithofacies maps which brings out the magnitude and rates of change in lithologic characteristics for selected stratigraphic intervals. The interval is divided into percentages of clastics and non-clastics which are combined into a "clastic ratio" and a "sand-shale ratio." Contour-type maps are made in which the two ratios may be combined to obtain the distribution of statistical lithologic associations. For the more detailed analysis of lithofacies variations a series of ratios is available, which helps differentiate basin, shelf, and geosynclinal deposits. Combinations of lithofacies and isopach maps aid the interpretation of tectonics and paleogeography.
E. N. T.

3. Pennsylvanian Stratigraphy and Structure, Velma Pool, Stephens County, Oklahoma. W. Mallory. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1948–1979.—Some 4340 ft of marine beds—the Springer, Dornick Hills, Deese, and Hoxbar formations—were deposited in this area during Pennsylvanian times. The area was then subjected to folding and thrusting, and an eastern block was complexly folded, overturned, and upthrust southwestward against a similarly deformed but structurally higher autochthonous mass. Subsequent erosion was followed by burial under 1000–2000 ft of Permian strata.
E. N. T.

4. Santa Ana, San Joaquín, Guario and Santa Rosa Oil Fields (Anaco Fields), Central Anzoátegui, Venezuela. H. J. Funkhouse, L. C. Sass and H. D. Hedberg. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1851–1908.—The authors present a detailed dis-

cussion of the Santa Ana, San Joaquín, Guario, and Santa Rosa oilfields (grouped together as the Anaco fields), which are in the centre of Anzoátegui State in eastern Venezuela. Since the discovery well was drilled in 1937, five additional domes have been found productive. At the beginning of 1947, seventy-one wells had been drilled, with a potential of 22,650 b.d.

The six drilled domes of the Anaco area have a northeast–southwest trend and extend over thirty miles. The four south-western structures are reflected at the surface by outcrops of middle Miocene beds surrounded by upper Miocene–Pliocene beds, but older beds of the two northeastern domes are completely and unconformably covered by the younger beds. The closest seepage is 35 miles distant. The discovery well was located by surface and aerial geology, and the other structures were drilled on geological plus reflection seismograph information, except the two northeast domes which were drilled on reflection seismograph results alone.

The local geological section is as follows : Sacacual Group (upper Miocene–Pliocene) 0–1600 ft thick. Unconformity. Freites formation (Middle Miocene) 0–2100 ft thick. Possible Unconformity. Oficina formation (Oligocene–Miocene) 7500–10,000 ft. Merecure formation (upper Eocene–lower Oligocene), more than 1900 ft thick (base not yet reached).

All the Anaco domes are asymmetrical with steep southeast flanks and relatively gentle northwest flanks; the domes are separated by saddles or by sharp synclines which are probably faulted. The structures are thought to be the result of drag over a northwest-dipping zone of thrust faulting. Accumulation is mainly controlled by the structural closure with sand lenticularity of local importance.

Production is from sands in the Oficina and Merecure formations. Twenty-eight Oficina sands have produced oil, and at least fifteen additional Oficina sands have shown gas. Where tested, the Merecure formation has been gas- or oil-productive without exception. Oil-productive depths range from 3850 to 10,705 ft. The total productive surface area amounts to nearly 29,000 acres.

Reservoir pressures in the Oficina formation are locally 500–1000 p.s.i. in excess of hydrostatic pressure, whereas Merecure pressures are essentially in accordance with hydrostatic pressure. Production to date has been 33–47° A.P.I. wax oil with a small proportion of 44–57° A.P.I. condensate. The wax oils have a wax content of about 15% by weight and a pour point of about 85° F.

Dual-zone completions are common practice, and for the past few years only one sand has been perforated in each zone. All recent completions have been through gun perforations. Well spacing is on the equilateral-triangle system and varies from 25 to 126 acres or more. Pressure-maintenance projects are being discussed. The outlet of the fields is through the 155-km 16-in pipeline from the Greater Oficina area through the Anaco area to Puerto la Cruz on the Caribbean coast. E. N. T.

Geophysics and Geochemical Prospecting.

5. Flying Magnetometer Speeds Oil Search. Anon. *Petrol. Engr*, Sept. 1948, **19** (13), 55.—The use of the airborne magnetometer in geophysical prospecting is here described with the aid of photographs. C. G. W.

6. Patent. Texaco Development Corpn. B.P. 602,335, 9.6.48. Method and apparatus for removing random fluctuations from intensity measurements. G. R. N.

Drilling.

7. Casing Cementing and Perforation Practices. A. J. Teplitz. *Oil Gas J.*, 9.9.48, **47** (19), 69.—The technique of using casing centralizers and scratchers when cementing is now widespread. At present the procedure is to hold off bottom while circulating mud and reciprocating the casing. This frees the hole of cuttings and mud removed by the scratchers. The provision of a special casing head makes it possible to release and pump down the cement plug without stopping circulation or reciprocation. With the improved cementing obtained standard perforating methods are inadequate, and yet perforation may offer a solution. C. G. W.

8. Combination Casing Strings. B. E. Curran. *Oil Gas J.*, 14.10.48, **47** (24), 80.—Use of combination strings to reduce overall weight of a column of casing is widespread. The stresses on casing are threefold; (1) external hydrostatic forces; (2) tensile forces; (3) internal bursting pressure. In designing a combination casing string for collapse, problems arise. The usual procedure is to select a grade of casing to withstand the prevailing hydrostatic pressure at total depth and work upwards from the bottom section. The lower end of the string is taken as a starting point, since (1) maximum collapse pressure is encountered there; (2) there is no hanging load to influence the normal collapse resistance. The permissible length of a section has been determined by trial and error; to obviate the tedious work of determining this length an equation has been derived:

$$x = \frac{1}{a} + \frac{n}{b} - c\sqrt{1 - \left(\frac{1+n}{d}\right)}$$

where

x = unknown length

$$a = 1 - \frac{m-2}{m(2m-1)}$$

$$b = \frac{m(2m-1)}{m-2}$$

$$c = \frac{u}{\sqrt{1 + m(m-1)}}$$

$$d = \frac{2v}{\sqrt{3}}\left(\sqrt{1 + m(m-1)}\right)$$

$$n = W/w = \frac{\text{total hanging load on a section}}{\text{weight per unit length of the section}}$$

$u = ASo/w$

A = metal cross-sectional area

So = average yield strength.

$V = K/pF$.

K = minimum collapse resistance at the lower end of the upper section.

p = hydrostatic pressure gradient.

F = factor of safety.

$$m = u/v = \frac{pFAso}{wk}.$$

This equation is applied to an example calculating three sections of casing. The derivation of the equation is made as an appendix to the paper. C. G. W.

9. New Completion Technique. D. H. Stormont. *Oil Gas J.*, 16.9.48, **47** (20), 99.—Use of casing centralizers and scratchers in completion operations has increased. Objects are (1) scratchers remove filter cake permitting cement to bond to formation; (2) centralizers cut through tight areas and assure a concentric ring of cement; (3) centralizers and scratchers permit cement to be "worked" ensuring a homogeneous column.

Caliper and temperature surveys are run to determine the hole size and to find the top of the cement column.

Centralizers are installed at 90-ft intervals while the casing is racked. Details of the mechanics of completion are described. C. G. W.

10. Diamond Coring in California. W. C. Harrington and M. C. Eastman. *Petrol. Engr Ref. Annual*, **19** (10), 84.—Diamond coring equipment has been restricted to one zone in three fields being uneconomical in soft and medium strata. The method failed to core hard schists and basalts due to the fracture of these rocks.

Bits with flat bottom surface without water courses on the bottom surface have been most satisfactory. Other practices and preferences of operators are mentioned. C. G. W.

11. Cutting and Fishing. F. Briggs. *Oil Gas J.*, 7.10.48, **47** (23), 225.—This is a general article on cutting and fishing tools and methods. Some modern tools are illustrated and one deep fishing job described. C. G. W.

12. Economic Trends in Contract Drilling. J. E. Warren. *Petrol. Engr Ref. Annual*, 1948, **19** (10), 51.—Major drilling operations are analysed from both standpoints of cost and time. Rising costs have caused a trend to greater operating efficiency and reduced drilling time. The relations of cost per day and cost per foot to total drilling time are deduced from actual experience from 1944 to 1947. Costs per day increase more rapidly with shorter drilling time, while there is an optimum drilling time for minimum costs per foot.

The general trend in contract drilling is a cycle of progress and stagnation and, if present specific trends continue, *i.e.*, high costs, low reserve, competitive drilling, efficiency will deteriorate and a period of stagnation occur. A measure of stability would be an economic gain to the entire petroleum industry. C. G. W.

13. Planning a Multiple Well Directional Drilling Programme for Offshore Locations. J. G. Jackson and J. B. Murdoch, Jr. *Petrol. Engr Ref. Annual*, 1948, **19** (10), 55.—*See Abstract* No. 25 (1948).

14. Offshore Drilling Development. D. A. McGee, T. F. Seale, and G. O. Danielson. *Petrol. Engr, Ref. Annual*, 1948, **19** (10), 65.—The article describes the development of Kerr-McGee industries offshore block. The method adopted was platform and floating barge with warehouse, living quarters, equipment, etc., provided on the barge.

Full details of the project from survey to well completion are described. C. G. W.

15. Mountain Top Drilling. H. David. *Oil Gas J.*, 16.9.48, **47** (20), 212.—Inaccessibility of favourable locations in California has led to directional drilling of a number of wells from one site. A site is selected, roads built, and a large reinforced-concrete slab laid. From this as many as eight wells may be drilled, each to the centre of a separate 5-acre plot. Sumps and storage tanks are located nearby. Drilling practices of the region are described. C. G. W.

16. Today's Drilling Rigs. Anon. *Oil Gas J.*, 7.10.48, **47** (23), 149.—This thirty-two-page symposium gives descriptions and specifications of the rigs at present being produced by the manufacturers of drilling equipment. All types of drilling equipment are featured and described. C. G. W.

17. Rigs for 20,000 ft Wells. S. R. Mahan. *Oil Gas J.*, 7.10.48, **47** (23), 195.—The economics of deep drilling demand correct design of new equipment, since the limitations of much existing equipment have been reached. (1) Drilling line: diameters up to 1¼ in compared with the normal 1¼ in give good results and give the required safety margin. (2) Drill pipe and tool-joints: drill-pipe of 105,000 p.s.i. and tool joints of 165,000 (A.P.I. grade, in use 75,000 and 115,000 p.s.i.) are in production. Improved connexions are necessary—shrink-thread joints are satisfactory, and baked plastic coatings are useful for corrosion prevention. (3) Derrick: latest A.P.I. standard is 189 ft, water-table opening 7½ ft, base square 37½ ft, derrick capacity 900,000–1,500,000 lb, gin pole capacity 20,000 lb, rated actual wind velocity 100 m.p.h. (4) I.C. engines of sufficient power are available. (5) Slush pumps are available with capacities 640 and 700 hydraulic h.p. At 20,000 ft, two such pumps would be necessary. Trends in draw-works design and other features aare also discussed. C. G. W.

18. Research Rig for Drilling Studies. G. Weber. *Oil Gas J.*, 21.10.48, **47** (25), 85.—The rig is more or less conventional. Two mud-pumps fitted with pulsation dampers, air slips, a dynamatic brake fitted to Moore 136 ft derrick, are main features. Bit weight, rotary speed, relative rotary torque, penetration rate, and pump discharge pressure are measured and recorded. An automatic record is taken of pit levels and mud weight, and fuel consumption is recorded.

A major project is the comparison of the theory of flow of mud and slurries (plastic

flow) with the behaviour under rig conditions. Factors affecting cementing are also under investigation. Minor problems under review are the effects of various practices on penetration rates, and the testing of new equipment. C. G. W.

19. Experimental Well. C. E. Clason. *World Petrol.*, Aug. 1948, **19** (9), 40.—At the high pressures and temperatures existing at the drilling depths likely to be encountered, existing equipment will probably have to be modified. To study the behaviour of equipment Halliburton have built an experimental well. The well consists of a 9-ft long pressure chamber working pressure 20,000 p.s.i. set in a concrete bath. Temperature control is effected by circulation of hot oil. Pressures are obtained by oil from a low-volume high-pressure pump. C. G. W.

20. Engineering Factors in Measuring Well Depths. C. R. Searcy. *Petrol. Engr*, Sept. 1948, **19** (13), 76.—Accurate depth measurements of oil wells are essential if satisfactory completions are to be made. Well depths as measured by drilling string, casing and tubing strings may differ considerably and knowledge of the factors involved in measurement is invaluable. Some sources of measurement errors are: (1) changing of original well zero; (2) inaccurate tapes; (3) inaccurate reading or recording; (4) stretch under load of the string; (5) temperature corrections; (6) errors of personnel such as changing joints, kelly, or drill collars without measuring. Other sources of error depend on the well condition, *e.g.* (1) cement plug drilled using water—the cuttings settle, giving an error on measurement; (2) well fluid condition—mud may settle if badly conditioned; (3) plug drilled with a small bit—the residual cement sloughs off and settles on bottom.

The practices of servicing companies in making depth measurements are discussed. C. G. W.

21. Patents. National Supply Corpn and Oil Well Engineering Co. Ltd. B.P. 600,294, 14.4.48.—Devices for anchoring the hoist lines of rotary earth boring apparatus and indicating the line pull thereon.

National Supply Corpn and Oil Well Engineering Co. Ltd. B.P. 600,488, 21.4.48.—Sprocket mountings.

National Supply Corpn and Oil Well Engineering Co. Ltd. B.P. 603,641, 30.6.48.—Consolidated rigs for drilling wells or boreholes.

English Drilling Equipment Co. Ltd., and F. Walmsley. B.P. 608,149, 22.9.48.—Swabs for use in oil wells. G. R. N.

Production.

22. Corrosion Prevention with Organic Inhibitors. W. F. Gross and H. W. Andrews. *Oil Gas J.*, 28.10.48, **47** (26), 76.—Corrosion prevention may be effected by: (1) changing the nature of the corrosive fluids; (2) changing the nature of the corroding metal; (3) insulating the metal surface from the corrosive fluids. A new method of type (3) uses complex organic semi-polar compounds. These are strongly adsorbed to form a protective film, thus reducing the rate of diffusion of corroding fluids to the metal surface.

The additives are not affected by brine or hydrogen sulphide and do not raise the pH of the brine. The results of field tests of four such inhibitors in six wells are tabulated and discussed.

No preparation of the well subsurface equipment is necessary before starting treatment, and the protection lasts with diminishing effect for several weeks after treatment is stopped. C. G. W.

23. Gas Cycling Plant. W. T. Robertson and H. M. Stamper. *Oil Gas J.*, 9.9.48, **47** (19), 64.—This plant processes 485 million cu. ft/day recovering 80% of butanes and 100% of heavier hydrocarbons. Gas is taken from thirty-three wells working pressure 2700 p.s.i. 130° F. The injection system is designed for 3500 p.s.i. at 175° F. Wet gas is cooled, passed through separators into absorbers, and the residue gas is scrubbed. Condensate is flashed in stages, the flashed gases passing through re-absorbers. The distillation system for treatment of rich oil from absorbers and the

steam and power systems for the plant are described. Flow sheets and photographs are presented. C. G. W.

24. Hydrafac Process. J. B. Clark. *Oil Gas J.*, 14.10.48, **47** (24), 76.—The stages of this process are (1) injection of viscous liquid containing sand or granular material under high pressure to fracture the formation; (2) reduction of viscosity of liquid to displace it from formation.

The fluid used was a gel of hydrocarbon and soap. Addition of water to the gel will cause reversion to a sol within controllable time limits. In applying the method to thick sands formation packers must be used to enable multiple fracturing to be performed. Significant increases in production were obtained in eleven out of twenty-three operations. C. G. W.

25. Field Results of Jet Perforator Charges. R. Harcus. *Petrol. Engr Ref. Annual*, 1948, **19** (10), 107.—The results of field experiments with shaped-charge perforators in severing casing and perforating are discussed. It is concluded that although the method is still only in the development stage it is of great value, being free of the drawbacks of bullet perforation. C. G. W.

26. Distribution of Pumping Costs. R. Sneddon. *Petrol. Engr*, Sept. 1948, **19** (13), 51.—A reliable indication of the distribution of pumping costs is useful in the interests of economy and as a means of comparing costs between like systems in different areas. A survey was recently undertaken to determine such a distribution. The results indicate that the survey was inadequate, but also indicate adjustments that will be necessary in any future survey. Labour and pulling costs average 50%, surface and subsurface repair about 25% of the total costs. Results are presented graphically. C. G. W.

27. Desirable Characteristics of Pumping Units and Engines. J. C. Slonegger, *Petrol. Engr Ref. Annual*, 1948, **19** (10), 120.—The polished rod load on a pumping unit produces a torque at the reducer crankshaft. This torque depends on the geometry of the unit. Suggested proportions for best overall results are: working centre of well and of working beam = $1\frac{1}{2}$ × maximum stroke.

Samson post height = $2\frac{1}{2}$ × max. stroke + 6 in. Requirements of a prime mover for well service are: (1) must overcome periodic load; (2) run at uniform speed; (3) wide range of speed; (4) operate 24 hr/day under full load; (5) as simple and rugged as possible; (6) easy to start and service; (7) operate the year round and under partial loads. To fulfil these requirements the author suggests the use of heavy flywheels, damped governors, and rigid crankshafts. Vapour or steam cooling permits operation under wide ranges of climate and load. The single cyclinder horizontal engine is advocated up to 30 h.p. C. G. W.

28. Patents. Indo-Burma Petroleum Co. Ltd. and N. F. Brown. B.P. 606,021. 18.8.48.—Packing members for pump plungers and means for securing the packings thereto.

National Supply Corpn and Oil Well Engineering Co. Ltd. B.P. 607,874, 22.9.48.—Pump drives. G. R. N.

Transport and Storage.

29. Trans-Arabian Line will be Outlet for 300,000 Brl of Crude. B. E. Hull. *Oil Gas J.*, 23.9.48, **47** (21), 167, 270–271.—Trans-Arabian Pipe Line Co. is building 1070 miles of 30–31-in pipeline and a terminal to carry 300,000 brl of crude daily from fields in Saudi Arabia to the new refinery planned at Sidon on the Mediterranean, and to the coast for shipment. Difficulty is being experienced in obtaining sufficient quantities of steel, and the pile-up of other materials and supplies is creating a great storage problem.

When completed the line will have six pump stations, about 180 miles apart, and will need 323,000 tons of steel; if the throughput is increased to 500,000 b.d., an extra 42,000 tons of steel will be necessary. A fleet of 102 16,000-ton tankers would

be required to maintain this daily movement of crude from Persian Gulf to Mediterranean, and it is calculated that the pipeline will cut down transport costs considerably.

Special features of construction are: shipment of pipe in nested units; welding of lengths of pipe at seaport; use of 15-ton motor trucks; use of new type of aerial cableway 3 miles long from ship to shore. W. M. H.

30. Today's Natural Gas Construction Methods in Laying 26 and 30–31 in Pipe Lines. P. Reed. *Oil Gas J.*, 23.9.48, **47** (21), 180–188.—Modern methods for laying natural-gas lines are exemplified in the construction of the 210 miles of 30- and 31-in pipe for Tennessee Gas Transmission Co., and the 180 miles of 26-in pipe for Cities Service Gas Co. in Kansas. Practices described in these projects include denesting; double jointing, in yards and on the right-of-way; use of electric-operated internal line-up clamps; X-ray inspection of welding; coating and wrapping; machine bending; and utilization of radio communication between construction units in the field. W. M. H.

31. Locating and Repairing Leaks in "Biggest Inch" Natural Gas Pipeline. Anon. *Oil Gas J.*, 28.10.48, **47** (26), 103.—A rapid method of making accurate continuous leak surveys over long sections of the natural-gas line which extends from the Permian basin in West Texas to Los Angeles has been developed by the Southern Counties Gas Co., California.

The device, called a "sniffer," can withdraw air samples from 14–15 in below the surface of the ground, while it is being towed along on the surface. It looks like a plough mounted on semicircular skids, the blade carrying a ½-in pipe terminating in several 1/8-in holes near the point of the blade, which is set to submerge approximately 15 in below the surface. Air samples are withdrawn by vacuum through an electrical detector located in the cab of the power unit.

Leaks are stopped by placing encircling steel bands, rather than patches, round the pipe. By means of a wrinkle in the band, and a vent nipple, gas can be vented from the leak so that welding of the band can take place. A plug is screwed into the vent nipple after the band welding, and a cap welded over this, completing the weld.

Washouts due to heavy rainfalls have been prevented by cutting waterways across the backfall at intervals to guide the water across and away from loose earth. G. A. C.

32. Pipelines Under Water. C. M. Wilson. *Pipe Line News*, Nov. 1948, **20** (11), 9.—It is generally agreed that water is one of the great hazards of pipeline systems and that any faults in a system are most apparent under water. In crossing the Arkansas River many precautions were taken, particularly as the Big Inch line crossing this river had been torn out some years previously. The main crossing of 600 ft was extended 3000 ft to the west and 6000 ft to the east of the main channel, and further the main 26-in line was split into two 20-in branches. Iron collars weighing 1800 lb spaced at 50-ft intervals in the approaches and 15-ft intervals in the channels, form riverweights. The pipe is cleaned, primed, tarred, and coated with asbestos-felt paper. Drifting or floating is further prevented by saddles at 100-ft intervals anchored to the bottom of the trench. C. G. W.

33. Fully Automatic Crude Oil Gathering Stations. F. H. Warren. *Pipe Line News*, Nov. 1948, **20** (11), 16.—When starting water-flood operations it became necessary to recondition the gathering system for the field. The stations are entirely electrically operated. An air separator is placed in the gravity line from the field. This is split into two compartments by a vertical partition little more than half the height of the separator. Oil is transferred from the separator to a storage tank by a rotary pump and from storage to a trunk line by a constant-speed piston pump; automatically recorded time of pumping gives the volume of oil discharged. The air separator is maintained under a vacuum of 8 in of mercury unless the tank is filled to a level where a float switch starts the transfer pump and shuts down the vacuum pump. A solenoid valve prevents oil going to the vacuum pump. A second float switch in the separator shuts down the transfer pump when the level in second compartment drops to a certain point. The discharge pump is similarly started by a float switch in the storage tank. C. G. W.

34. Interfacial Mixing Characteristics of Products in Products Pipelines. I. S. S. Smith and R. K. Schulze. *Petrol. Engr*, Sept. 1948, **19** (13), 94.—Laboratory studies of mixing characteristics of products flowing in pipelines are described. The work was done on pilot-plant scale, although field construction and development of technique were proceeding concurrently. The first plant consisted of 5000 ft of 0·6 in I.D. tubing with a water pump driven by a 10-h.p. motor. The pipe was laid as a closed system. Volume measurements were made by a carefully calibrated 1-in piston meter and the degree of mixing by a novel form of gravitometer. This consists of a loop of the pipe supported on a drum floated in the water bath. Ballast is added to or taken from the drum so that the loop of pipe is just supported. Change of gravity of circulating fluid causes vertical motion of the drum which is indicated by a beam-and-lever mechanism of a Toledo Scale. It is claimed that this gravitometer will differentiate between products with a sp. gr. difference of only 0·001.

Later, 2-in tubing was substituted with new pumping equipment with refinement, so that commercial practices such as scraping, could be adopted. The same range of velocities and Reynolds Numbers as used in commercial installations was investigated. Products used were propane, butane, gasolines, kerosines, and fuel oils.

It was endeavoured to find the lowest economic velocity for any given pair of products and to investigate the higher velocities. Full results and discussion are not presented.

Incidental conclusions are: (1) that the 50/50 mix point is at the same location as the original interface; (2) adhesion of the first batch liquid to the wall leaves a film of approx. 0·003 in independent of the velocity of the stream. C. G. W.

35. Cost-imating. Construction Steel. W. L. Nelson. *Oil Gas J.*, 4.11.48, **47** (27), 111.—No. 3 in this new series gives tables showing cost indices for construction steel for the years 1924–48, including material and labour costs, and costs of construction of cylindrical vessels, tanks, forging, ladders, pipe and pipe lines, etc. Cost index for 1946 is taken as 100. G. A. C.

36. Pump-Station Design and Control Features of Magnolia's 20-in Line. E. J. Wacker. *Oil Gas J.*, 23.9.48, **47** (21), 172–173, 272–274.—The new Magnolia pipelines from Texas to Illinois came into operation in June 1948, with a capacity of 100,000 b.d. The line is 648 miles long, with four pump stations, and is operated as a closed system, dispatched by the chief dispatcher using only telephone communication.

Full details are given of pump-rooms and their equipment, methods of control and testing, heating, ventilating, and construction of buildings. W. M. H.

37. Features of a Modern Diesel-Pump Station. F. H. Warren. *Oil Gas J.*, 23.9.48, **47** (21), 218.—At the end of the war, Ohio Oil Co. replaced the 1906 steam station at Martinsville, Ill., with a modern diesel station.

Four booster pumps were installed to discharge oil into the main suction manifold. They are driven by three 60-h.p. and one 75-h.p. motors. There are three six-stage centrifugal discharge pumps, each designed for a capacity of 65,000 b.d., the prime movers being seven-cylinder crude-oil-burning four-cycle diesel engines. The crude oil used for fuel is taken directly from the main suction lines.

Methods of control are noteworthy, consisting of a central control panel in front of each engine. Engine performance is good, and major overhauls are planned at two-year intervals. W. M. H.

38. Patent. Shell Development Co. B.P. 600,728, 28.4.48.—Pipeline corrosion inhibition. G. R. N.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

39. Corrosion of Non-Ferrous Tubes by Cooling Water in Refinery Heat Exchangers. A. G. Ellison. *British Petrol. Equip. News*, 1948, **1** (1), 27.—Dezincification and season cracking are uncommon in good-quality brass tubes. Corrosion–erosion may

be prevented by using such alloys as 76/22/2 aluminium–brass and 70/30 copper-nickel. Care should be exercised to: (1) prevent gas entanglement in the cooling water; (2) stream line the entry of water into the heat-exchanger tubes with minimum turbulence in the water box, and (3) prevent entry of solid bodies liable to get lodged in the tubes. No alloy is wholly resistant to deposit attack and oxide pitting, but much depends on the surface finish of the tubes used. J. T.

40. Heat Transfer with Surface Boiling. J. W. Knowles. *Canad. J. Res.*, 1948, **26***A* (4), 268–278.—Water flowed in the annulus between an electrically heated stainless-steel tube and a larger dia glass tube. The outside surface temp of the heater tube was calc. from the elec energy dissipated in the tube and the temp registered by a thermocouple inside the tube. The bulk temp of the water was below the b.p., and the surface temp of the heat-transfer tube went *ca* 100% above the b.p. Water velocities ranged up to 10 f.p.s., and heat fluxes up to 720 W/cm.^{2} The const a in the Dittus and Boelter formula $(Nu) = a\ (Re)^{0.8}(Pr)^{0.4}$, which under normal forced convection has a value of $2{\cdot}3 \times 10^{-2}$, increased under surface-boiling conditions to four times the normal value. a bears a simple relation to the heat flux and the length–dia ratio for surface temps below a certain value (T). For const heat flux and vol flow rate, the surface temp rises with rising bulk liq temp until T is reached. With further rise in the bulk liq temp, the surface temp remains const at T until conditions became too unstable for measurements. D. F. J.

41. Maintenance of Multitubular Heat Exchangers. A. W. Trantor. *British Petrol. Equip. News*, 1948, **1** (1), 23.—Numerous important features in the care and maintenance of heat exchangers are given. J. T.

42. Selection of Insulating Materials. W. R. M. Belcher. *British Petrol. Equip. News*, 1948, **1** (1), 30.—Selection of insulating materials is broadly discussed. J. T.

43. Mechanical Seals in Modern Refinery Pumping Practice. N. Tetlow. *British Petrol. Equip. News*, 1948, **1** (1), 15.—The history and purpose of mechanical seals in refinery pumping practice is outlined. A number of British and American single- and double-shaft seals are described and illustrated. J. T.

44. Patents. Anglo-Iranian Oil Co. Ltd., A. P. Shearer, and T. Cubin. B.P. 600,468, 21.4.48.—Production and recovery of *iso*paraffins, more particularly *iso*-pentanes.

Anglo-Iranian Oil Co. Ltd., M. E. Kelly, and J. Dove. B.P. 600,574, 28.4.48.—Fractional distillation.

Phillips Petroleum Co. B.P. 600,679, 28.4.48.—Process for the production of gasoline stocks.

Anglo-Iranian Oil Co. Ltd., and P. Docksey. B.P. 600,801, 5.5.48.—Production of high-grade aviation or motor fuels by fractional distillation.

R. T. Anderson. B.P. 603,909, 7.7.48.—Oil-settling apparatus.

Lummus Co. B.P. 605,044, 28.7.48.—Oil heater.

H. C. Glitsche and F. W. Glitsch, Jr. B P. 606,318, 25.8.48.—Bubble-tray downcomers.

H. C. Glitsch and F. W. Glitsch, Jr. B.P. 606,870, 1.9.48.—Tray assembly for an absorption tower.

Anglo-Iranian Oil Co. Ltd., A. R. Morsman, and R. Rousset. B.P. 607,202, 8.9.48.—Liquid-level indicators.

Anglo-Iranian Oil Co. Ltd., and E. Andrews. B.P. 607,866, 22.9.48.—Valves.

A. D. Little Inc. B.P. 608,037, 22.9.48.—Distillation method and apparatus.

Distillation Products Inc. B.P. 608,249, 22.9.48.—Apparatus for producing a vacuum.

J. H. Wiggins. B.P. 608,308, 29.9.48.—Floating roof for liquid storage tanks.

J. P. Loumiet. B.P. 608,595, 29.9.48.—Apparatus for distilling hydrocarbon and tar oils. G. R. N.

Distillation.

45. Vacuum Distillation Equipment. R. M. Blaize. *Refiner*, Sept. 1948, **27** (9.1), 480.—The author explains the need for laboratory vacuum-distillation data before the design of plant is begun. Data is given for the number of trays required, the tray separation, and the column diameter. Typical top-of-column lay-outs of condensers and ejectors are shown. The economy in operating costs obtained by having the minimum pressure loss between the flash zone and the vacuum equipment is emphasized. H. A. C.

Cracking.

46. Study of Operating Variables in Thermofer Catalytic Cracking. C. Bednass, D. M. Luntz, and R. E. Bland. *Chem. Engng Prog.*, Apr. 1948, **44** (4), 293.—From this study it has been concluded that max gasoline yields are obtained by a combination of high catalyst activity, low temperature, and low space velocity. Octane, particularly Research octane, values are improved by increase in reaction temperature though these gasolines have poor lead susceptibility. O. M.

47. Lion Oil Catalytically Processes Sour Gas Oil. W. Carney, H. D. Noll, and A. W. Hoge. *Oil Gas J.*, 4.11.48, **47** (27), 69.—The 5400 b.d. T.C.C. unit of the El Dorado, Ark, refinery of the Lion Oil Co. processes charging stock with an average sulphur content of about 1·7% wt with low-temperature operation and a nominal amount of internal recycling.

A minimum amount of chemical treatment of the catalytic gasoline is required to obtain a satisfactory product.

The T.C.C. unit consists of the conventional heater tar separator, reactor-kiln, and distillation sections; only the reactor in the catalytic section having alloy protection against corrosion by the sour charging stocks. The catalyst used is the synthetic bead type, and its performance is shown graphically.

Tables give inspection data for products, sulphur distribution in T.C.C. cracking, major equipment and type of material, and condition of equipment after seven months' operation, the latter showing the excellent condition in which the equipment was found. G. A. C.

48. Clay Minerals as Catalysts. R. H. S. Robertson. *Industr. Chem.*, 1948, **24**, 746–749.—Commercial clays are classified according to basal spacing of the lattice. Mention is made of the mixed gel cat and use of acids, aluminium chloride and bromide and other salts with clay cat. The activation of clays by acids and by heat treatment and its effect on reactions and subsequent regeneration is discussed. Reference is made to work on essential oils, cat cracking, and general organic synthesis. Factors involved in determining catalytic behaviour of clays include water content, acid-like behaviour, adsorptive power, proportion of active surface, lattice structure, base-exchange capacity, micromeritic, and rheological properties. E. B.

49. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 599,920, 7.4.48.—Catalytic materials.

Universal Oil Products Co. B.P. 600,470, 21.4.48.—Catalytic conversion of hydrocarbons.

J. C. Arnold (Standard Oil Development Co.). B.P. 600,677, 28.4.48.—Catalyst.

Standard Oil Development Co. B.P. 600,802 and 600,813, 5.5.48.—Process for the regeneration of catalysts used in reforming hydrocarbons.

J. C. Arnold (Standard Oil Development Co.). B.P. 600,840, 5.5.48.—Process for the conversion of hydrocarbon oils.

J. C. Arnold (Standard Oil Development Co.). B.P. 601,389, 20.5.48.—Process for contacting solid particles with gaseous fluids.

C. Arnold (Standard Oil Development Co.). B.P. 601,544, 20.5.48.—Method of dehydrogenating mono-olefin and alkylated aromatic hydrocarbons.

J. C. Arnold (Standard Oil Development Co.). B.P. 601,679, 26.5.48.—Catalytic conversion of hydrocarbons.

Standard Oil Development Co. B.P. 601,723, 26.5.48.—Process for the continuous treatment of solids and gases.

Houdry Process Corpn. B.P. 602,240, 2.6.48.—Catalysis.

J. C. Arnold (Standard Oil Development Co.). B.P. 602,263, 2.6.48.—Dehydrogenation of butenes.

J. C. Arnold (Standard Oil Development Co.). B.P. 602,471, 9.6.48.—Hydrocarbon conversion process.

Phillips Petroleum Co. B.P. 602,499, 9.6.48.—Manufacture of butadiene.

Shell Development Co. B.P. 602,780, 16.6.48.—Production of catalytically cracked gasoline.

J. C. Arnold (Standard Oil Development Co.). B.P. 603,729, 7.7.48.—Drying of hydrous oxide gel particles.

H. W. K. Jennings (Standard Oil Co.). B.P. 604,395, 14.7.48.—Cracking of hydrocarbons.

H. W. K. Jennings (Standard Oil Co.). B.P. 604,410, 14.7.48.—Catalytic averaging of hydrocarbons.

Phillips Petroleum Co. B.P. 604,432, 14.7.48.—Process for hydrocarbon conversion.

C. Arnold (Standard Oil Development Co.). B.P. 604,959, 28.7.48.—The catalytic treatment of hydrocarbons.

Shell Development Co. B.P. 605,515, 5.8.48.—Catalytic process and apparatus.

J. C. Arnold (Standard Oil Development Co.). B.P. 605,868, 18.8.48.—Catalyst.

C. Arnold (Standard Oil Development Co.). B.P. 606,664, 1.9.48.—Process for the catalytic hydroforming of naphthas.

J. C. Arnold (Standard Oil Development Co). B.P. 606,964, 8.9.48.—Catalytic hydroforming of naphthas.

C. Arnold (Standard Oil Development Co.). B.P. 607,234, 8.9.48.—Process for the preparation of gel particles.

Universal Oil Products Co. B.P. 607,256, 8.9.48.—Process for catalytically dehydrogenating hydrocarbons.

Polymerization.

50. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 600,317, 21.4.48.—Process for the low-temperature polymerization of olefins.

Shell Development Co. B.P. 606,807, 1.9.48.—Production of synthetic elastomers.

J. C. Arnold (Standard Oil Development Co.). B.P. 608,665, 29.9.48.—Hydrocarbon copolymers. G. R. N.

Alkylation.

51. Patents. Anglo-Iranian Oil Co. Ltd., and A. P. Shearer. B.P. 599,906, 7.4.48.—Use of liquid alkylation catalysts in the alkylation of hydrocarbons.

C. Arnold (Standard Oil Development Co.). B.P. 600,505, 21.4.48.—Alkylation of aromatic hydrocarbons.

Koppers Co. Inc. B.P. 601,692, 26.5.48.—Synthesis of ethylated aromatic hydrocarbons.

J. C. Arnold (Standard Oil Development Co.). B.P. 602,005, 2.6.48.—Alkylation of *iso*paraffins.

J. C. Arnold (Standard Oil Development Co.). B.P. 604,278, 14.7.48.—Catalytic alkylation of *iso*paraffins and olefins. G. R. N.

Isomerization.

52. Patents. Texaco Development Corpn. B.P. 600,011, 14.4.48.—Isomerization of saturated hydrocarbons.

Anglo-Iranian Oil Co. Ltd., and E. W. M. Fawcett. B.P. 601,202, 12.5.48.—Production of branched-chain alkenes.

J. C. Arnold (Standard Oil Development Co.). B.P. 601,702, 26.5.48.—Catalytic isomerization of paraffins and preparation of catalysts therefore. G. R. N.

Chemical and Physical Refining.

53. Rate of Approach to Equilibrium of Fractionating Columns. C. Berg and T. J. Jones, Jr. *Chem. Engng Prog.*, Apr. 1948, **44** (4), 307.—To obtain highest efficiency of fractionating equipment, the rate at which the composition of the reflux stream approaches maximum concentration while coming to equilibrium at total reflux is sometimes of considerable importance. This article contains mathematical expressions which will aid in the prediction of this variable in operation-time cycles, and where this factor is important, should permit design and construction of fractionating equipment which operates with greater efficiency from production and economic standpoint. O. M.

54. Patents. C. Arnold (Standard Development Co.). B.P. 600,063, 14.4.48.—Separation and concentration of olefins.

Soc. Gen. des Hules de Petrole and others. B.P. 600,995, 5.5.48.—Methods of treating oils.

Steel Bros & Co. Ltd., A. D. Armstrong, J. Mitchell, A. M. Fraser, and W. H. Chulmers. B.P. 601,212, 12.5.48.—Separation of wax from crude-wax fractions obtained from petroleum distillates.

Shell Development Co. B.P. 601,978, 2.6.48.—Process for the regeneration of caustic alkali solutions containing mercaptans.

Anglo-Iranian Oil Co. Ltd., and L. C. Strang. B.P. 602,097, 2.6.48. Refining of hydrocarbons.

Shell Development Co. B.P. 602,271, 2.6.48. Separation of non-aromatic hydrocarbons from hydrocarbon mixtures.

Shell Development Co. B.P. 603,808, 7.7.48. Catalytic treatment of sulphur-bearing hydrocarbon distillates.

Steel Bros & Co. Ltd., A. D. Armstrong, J. Mitchell, A. M. Fraser, and W. H. Chulmers. B.P. 605,936, 18.8.48. Refining of crude wax obtained from mineral oil.

Anglo-Iranian Oil Co. Ltd., S. F. Birch, J. Habeshaw, and C. B. Collis. B.P. 606,797, 1.9.48. Separation of narrow-boiling hydrocarbon fractions.

Anglo-Iranian Oil Co. Ltd., S. F. Birch, J. Habeshaw, and R. A. Lowry. B.P. 606,798, 1.9.48. Production of pure hydrocarbons from petroleum naphtha and other hydrocarbon feedstocks.

Anglo-Iranian Oil Co. Ltd., S. F. Birch, R. A. Lowry, and C. B. Collis. B.P. 606,799, 1.9.48. Production of hydrocarbons from petroleum naphtha.

Anglo-Iranian Oil Co. Ltd., S. F. Birch, J. Habeshaw, and C. B. Collis. B.P. 606,800, 1.9.48. Preparation in a condition of purity of benzene and/or *cyclo*hexane from mixtures containing them.

Anglo-Iranian Oil Co. Ltd., S. F. Birch, J. Habeshaw, and R. A. Lowry. B.P. 606,811, 1.9.48. Preparation of *cyclo*hexane and alkylated aromatic hydrocarbons.

Standard Oil Development Co., and Rohmand Haas Co. B.P. 607,945–49, 22.9.48. Solvent extraction processes to obtain olefins, naphthenes, and aromatics from hydrocarbon mixtures.

Koppers Co. Inc. B.P. 608,266, 22.9.48. Obtaining valuable light-oil fractions from fuel distillates.

Anglo-Iranian Oil Co. Ltd., S. F. Birch, and C. B. Collis. B.P. 608,605–6, 29.9.48. Production and recovery of *cyclo*hexane from hydrocarbon mixtures. G. R. N.

Special Processes.

55. Products from Petroleum Halogenation. G. Egloff. *Oil Gas J.*, 14.10.48, **47** (24), 112.—A review of the diverse products obtained by halogenation of petroleum is given. Products include insecticides, soil fumigants, weed killers, anæsthetics, soporifics, refrigerants, heat exchange and anti-freeze compounds, rubbers, resins, plastics, solvents, anti-knock compounds, and chlorinated paraffin waxes.

A 7-million-dollar plant for production of glycerin from propylene in cracked gases and employing chlorine will soon be in operation, and the commercial manufacture of nylon from *cyclo*hexane (replacing some hydrogen by chlorine) is now contemplated. G. A. C.

56. Patents. N.V. Inter. Hydro Mij. B.P. 600,777, 28.4.48. Hydrogenation of organic compounds.

Standard Oil Development Co. B.P. 600,580, 28.4.48. Fischer synthesis.

Hydrocarbon Research Inc. B.P. 600,796, 28.4.48. Fluidizing process and apparatus for treating comminuted solid materials.

C. Arnold (Standard Oil Development Co.). B.P. 600,858, 5.5.48. Process for the separation of suspended carbon from aqueous acid solutions.

Shell Development Co. B.P. 601,986, 2.6.48. Production of aviation gasoline.

J. C. Arnold (Standard Oil Development Co.). B.P. 602,238, 2.6.48. Manufacture of organic mercaptans and sulphides.

J. C. Arnold (Standard Oil Development Co.). B.P. 602,303, 2.6.48. Manufacture of organic mercaptans and sulphides.

Bataafsche Petroleum Mij., M. Buis, B. C. Maas, and M. L. Murdoch. B.P. 602,627, 9.6.48. Method of and apparatus for carrying out highly exothermic reactions with short reaction times.

Bataafsche Petroleum Mij. B.P. 605,607, 11.8.48. Process for the decoloration of articles produced from halogen containing high molecular compounds.

Clark Bros. Co. Inc. B.P. 606,554, 1.9.48. Methods for the oxidation of saturated aliphatic hydrocarbons.

Bataafsche Petroleum Mij. B.P. 606,702, 1.9.48. Process for the stabilization of organic substances of high mol. wt. containing combined halogen.

C. Arnold (Standard Oil Development Co.). B.P. 606,863, 1.9.48. Process for the synthesis of hydrocarbons.

Clark Bros Co. Inc. B.P. 606,967, 8.9.48. Methods for the oxidation of saturated aliphatic hydrocarbon gases.

Phillips Petroleum Co. B.P. 607,296, 8.9.48. Manufacture of carbon black.

Texaco Development Corpn. B.P. 607,593, 15.9.48. Continuous process for manufacturing motor fuel hydrocarbons. G. R. N.

Metering and Control.

57. A.P.I. and Specific Gravity at High Temperatures. W. L. Nelson. *Oil Gas J.*, 7.10.48, **47** (73), 279.—No. 217 in the Refiner's Notebook series shows a chart giving observed A.P.I. and specific gravities for high temperatures from 195° F to 250° F in steps of 1° F.

The oils were considered to have a characterization factor of 10·5, and thus the use of the chart is confined to cracked residues. G. A. C.

58. Cost-imating Exchangers. W. L. Nelson. *Oil Gas J.*, 28.10.48, **47** (26), 117.—The second of a new series gives data for estimating costs of exchangers. Factors

for pressure and temperature, materials, type of construction, and installation costs are given, together with a chart showing basic costs for 1946. G. A. C.

59. Economic Thickness of Insulation. W. L. Nelson. *Oil Gas J.*, 14.10.48, **47** (24), 117.—No. 218 in the Refiner's Notebook Series gives a chart showing economical thickness and cost of insulation, temperature difference, values of heat, and percentage fixed charges. Tables show thermal conductivity for various substances and representative costs of fuels. G. A. C.

60. Patents. Texaco Development Corpn. B.P. 602,179, 2.6.48. Liquid-level measurement and control.

C. Arnold (Standard Oil Development Co.). B.P. 602,278, 2.6.48. Temperature control of exothermic reactions. G. R. H.

PRODUCTS.

Chemistry and Physics.

61. Catalytic Action of Aluminium Silicates. III. Conversion of 1 : 1-Diphenylamine to Styrene over Morden Bentonite. M. Morton and R. V. V. Nicholls. *Canad. J. Res.*, 1948, **26**B (8), 581–591.—Optimum conditions for the vapour-phase conversion of 1 : 1-diphenylamine to styrene and benzene over activated Morden bentonite are a temp of 600° C, rapid feed rates, and the use of water vapour as diluent. Ethyl benzene is a reaction product, and a reaction mechanism is postulated. D. F. J.

62. Comparison of the X-ray Diffraction and Nitrogen Adsorption Surface Areas of Carbon Blacks and Charcoals. J. C. Arnell and W. M. Barss. *Canad. J. Res.*, 1948, **26**A (4), 236–242.—Surface areas of carbon blacks and activated charcoals have been determined by X-ray diffraction and by low temp N_2 adsorption isotherms. Data was also obtained on samples of charcoal at various stages of activation and after calcination. The data indicated that all the samples examined were composed of small graphite-like crystallites which had specific surfaces of about 2500–3000 $m^2/cm.^3$ It is postulated that the crystallite surface represents the potential adsorption surface and that providing that crystal growth does not occur during activation, the activation process makes these surfaces available to external adsorbate. D. F. J.

63. Structure and Activity of the Chromium–Aluminium Oxide Catalyst System. R. P. Eischens and P. W. Selwood. *J. Amer. chem. Soc.*, 1948, **70**, 2271.—Surface-area measurements were made, which, when taken together with magnetic data support the view that at the " 1 " point of the susceptibility isotherm the chromia is scattered over the surface of the alumina in small piles approximately three-atom layers deep. Activity tests of a series of chromium–aluminium-oxide catalysts used in the cyclization reaction show that there is a close relationship between the magnetic susceptibility and the activity of the chromium in the catalyst. G. R. N.

64. Studies of the Fischer–Tropsch Synthesis. IV. R. B. Anderson, W. K. Hall, and L. J. E. Hofer. *J. Amer. chem. Soc.*, 1948, **70**, 2465.—Reduced cobalt–thoria–magnesia kieselguhr and cobalt–thoria–kieselguhr catalysts and similar preparations with one or more of the components omitted have been studied by nitrogen-surface areas and carbon-monoxide chemisorption at − 195° C, mercury and helium densities, and X-ray diffraction. The promoters were found to prevent excessive decreases in surface area on reduction. Kieselguhr as a carrier was somewhat effective in preventing the decrease of surface area on reduction, but its most important function was to prevent the decrease in bulk volume of the catalyst on reduction. The carbon-monoxide chemisorption studies showed that an appreciable fraction of the surface was occupied by promoter. G. R. N.

65. Hydrogen Transfer. I. V. N. Ipatieff, H. Pines, and R. C. Olberg. *J. Amer. chem. Soc.*, 1948, **70**, 2123.—The reaction of *p*-cymene with trimethylene, methyl-*cyclo*hexene, dihydrolimonene, 1-octene, and *cyclo*hexene in the presence of either

sulphuric acid or hydrogen fluoride was studied. Hydrogen transfer occurs when *p*-cymene reacts with the first three olefins; the products resulting from such reaction consist of *iso*pentane, methyl*cyclo*hexane, and *p*-methane respectively and 1 : 3 : 3 : tetramethyl-1-*p*-tolylendan, which is formed in each case. G. R. N.

66. Alkylation of Aromatic Hydrocarbons in the Presence of Anhydrous $AlCl_3$. F. Steegmuller. *Chim. et Ind.*, 1948, **60**, 441–442.—Mechanisms previously suggested for the alkylation of benzene by ethyl chloride and ethylene, with the aid of $AlCl_3$, are discussed, and alternative reactions proposed. It is experimentally shown that traces of HCl are essential to initiate the alkylation reaction between benzene and ethylene in the presence of $AlCl_3$. Reaction between dried (over P_2O_5) benzene and ethylene only proceeds to a limited extent before ceasing; addition of a trace of HCl (or water) enables it to continue. V. B.

67. Butylation of Benzene during Propylation in the Presence of Isobutane. F. E. Condon and M. P. Matuszak. *J. Amer. chem. Soc.*, 1948, **70**, 2539.—A 2 mol.-% mixture of benzene with *iso*butane was subjected to hydrofluoric-acid-catalysed alkylation with propylene. The principal reaction was *iso*propylation of benzene. Substantially no alkylation of *iso*butane occurred; however, *iso*butane reacted, yielding *tert.*-butylbenzene and *iso*- and *p-tert.*-butyl*iso*propylbenzenes. The composition of the product showed that benzene reacted approx. 350 times as readily as *iso*butane. G. R. N.

68. Adsorption of Butane on Glass Spheres. R. T. Davis and T. W. DeWitt. *J. Amer. chem. Soc.*, 1948, **70**, 1135.—Data for the adsorption of butane on glass spheres is reported for a relative pressure range from below 0·0001 up to near saturation at temperatures of − 78°, − 46°, and 0° C, and heats of adsorption have been calculated. The heat of adsorption tends to remain constant up to several per cent surface coverage after which it decreases approx logarithmically with increasing adsorption. G. R. N.

69. Isomerization of *cyclo*Hexane and Methyl*cyclo*pentane in the presence of Aluminium Halides. I. D. P. Stevenson and O. Buck. *J. Amer. chem. Soc.*, 1948, **70**, 2890.—The results of a study of the isomerization of *cyclo*hexane and methyl*cyclo*pentane in the presence of $AlCl_3$ and $AlBr_3$ are presented. The experiments confirm the lack of catalytic activity on the part of these halides in the absence of a promoter. It is shown that at 60° C: (1) hydrogen halides have no promotional effect on the isomerization activity of the aluminium halides; (2) water is a promoter of isomerization activity; (3) the catalysis by the aluminium bromide–water complex is homogeneous; (4) the catalysis by the aluminium chloride–water complex is partially homogeneous and partially heterogeneous. New evidence for the existence of intermediate compounds is given. G. R. N.

70. Isomerization of *cyclo*Hexane and Methyl*cyclo*pentane in the presence of Aluminium Halides. II. D. P. Stevenson and J. H. Morgan. *J. Amer. chem. Soc.*, 1948, **70**, 2773.—The equilibrium constant of the reaction *cyclo*hexane (liq) ⇌ methyl*cyclo*pentane (liq) was measured at 27°, 59°, and 100° C. It is represented by $\ln K = 4{\cdot}814 - 2059/T$. Among the products of side reactions there were identified by mass spectrometric analysis propane, butane, pentane, hexane, C_7, C_8 and C_9 naphthenes, and C_{12} binaphthenes. No evidence could be found for the formation of *cyclo*pentane or C_7 or higher alkanes. It has been found that butane, pentane, hexane, C_6, C_7 and C_8 naphthenes, and C_{12} binaphthenes are formed by the action of moist aluminium bromide in *cyclo*pentane at 100° C. G. R. N.

71. Solubility of Aluminium Bromide in *cyclo*Hexane. P. A. Leighton and J. B. Wilkes. *J. Amer. chem. Soc.*, 1948, **70**, 2600.—The solubility of $AlBr_3$ in *cyclo*hexane was determined in the temperature range 6·2–97·5° C the wt per cent in the liquid phase varying from 25·1 to 100. On a mol-fraction basis $AlBr_3$ is more soluble in *cyclo*hexane than in normal butane or normal hexane. G. R. N.

72. *cyclo*Pentene and *cyclo*Hexene. H. M. Huffman, M. Eaton, and G. D. Oliver. *J. Amer. chem. Soc.*, 1940, **70**, 2911.—Heat capacity data on *cyclo*pentene and *cyclo*hexene are given over the temperature range 12–300° K. Values of the triple points, heats of fusion, transition temperatures, and heats of transition were determined. Entropy values for the liquid state at 298·16° K were calculated. G. R. N.

73. Syntheses of some *cyclo*Propane and Spirane Hydrocarbons. R. W. Shortridge and others. *J. Amer. chem. Soc.*, 1948, **70**, 946.—The synthesis of three gem-dialkylpropanes is described; two of these are new, spiro-(2 : 5)-octane and 4-methyl-spiro-(2 : 5)-octane. Hydrogenation of these compounds indicated that cleavage of the *cyclo*propane ring seems to occur exclusively at the bond opposite to the gem disubstituted carbonation. G. R. N.

74. Reactions of Diborane with Hydrocarbons. D. T. Hurd. *J. Amer. chem. Soc.*, 1948, **70**, 2053.—At elevated temperatures using low concentrations, diborane and olefins give trialkylboranes, while with benzene phenylboron compounds are formed. The reactions of diborane with paraffins are complex and involve paraffin-chain rupture and paraffin-chain synthesis, as well as the formation of boron–carbon compounds. G. R. N.

75. Di*iso*propylbenzenes. F. W. Melpolder, J. E. Woodbridge, and C. E. Headington. *J. Amer. chem. Soc.*, 1948, **70**, 935.—The isolation of the three isomeric di*iso*propyl-benzenes from a high boiling propylene–benzene alkylate is described. The most important physical properties and the relative concentrations of the isomers in the alkylate are listed. Infra-red, ultra-violet, and mass spectra also are given, the former confirming the chemical evidence of the structure of the compounds isolated. G. R. N.

76. Fluorinated Derivatives of Ethane and Ethylene. VII. A. L. Henne and R. P. Ruh. *J. Amer. chem. Soc.*, 1948, **70**, 1025.—Improved physical constants are listed for twelve fluorinated derivatives of ethane and ethylene. G. R. N.

77. Critical Opalescence of Ethylene. S. G. Mason and O. Maass. *Canad. J. Res.*, 1948, **26B** (8), 592–603.—The opalescence of ethylene has been investigated in the region of the crit. temp. The opalescence of all crit. fillings increases as the temp is lowered, passing through a max at *Ts*, the crit. dispersion temp, and subsequently decreasing. On heating, the opalescence depends upon the thermal history of the system. According to the Einstein–Smoluchowski theory, *Ts* is identical with the classical crit. temp, *Tc*, whereas this work reports values of 9·20° C and 9·90° C for *Ts* and *Tc*. However, these results are not in basic conflict with the Einstein–Smoluchowski theory if the nature of the *P–V* isotherms and the properties of the anomalous two-phase system in the region of *Tc* are taken into account. D. F. J.

78. An Induction Period in the Alkylation of *iso*Butane by 2-Butene. T. D. Stewart and W. H. Calkens. *J. Amer. chem Soc.*, 1948, **70**, 1006.—Gaseous 2-butene was passed at a constant slow rate into a vessel filled with *iso*butane and containing vigorously stirred 96% sulphuric acid at 0° C. The 2-butene dissolved rapidly without reaction of the *iso*butane; after from 10 to 25 min consumption of *iso*butane started, and from then on the ratio of the two gases consumed was constant. The length of the induction period was largely independent of the time required to introduce a given amount of 2-butene, and was not affected by the presence or absence of an oil phase initially. It was affected by the rate of continued addition of the alkene, by the amount of acid present, and by the addition of small amounts of *tert.*-butyl alcohol. G. R. N.

79. Thermal Decomposition of *iso*Butylene. F. O. Rice and W. S. Haynes. *J. Amer. chem. Soc.*, 1948, **70**, 964.—The thermal decomposition of *iso*butylene probably proceeds through a short chain producing methane and allene. Under proper conditions a minimum amount of carbonaceous and tarry material is formed. Both allene and methylacetylene at about 60 mol % yield based on the decomposed *iso*butylene are the major reaction products. G. R. N.

80. Vapour Pressure, Orthobaric Densities and Critical Constants of *iso*Octane. J. H. Beattie and D. G. Edwards. *J. Amer. chem. Soc.*, 1948, **70**, 3382.—The vapour pressures and orthobaric densities of 2 : 2 : 4-trimethylpentane were determined from 150° to 250° C. These vapour pressures and those of E. R. Smith for 100° and 125° C are fitted by the equation $\log_{10} p$ (atm) $= 4{\cdot}43444 - 1650{\cdot}17/T$. The critical constants were determined by the compressibility method, being $t_c = 271{\cdot}15 \pm 0{\cdot}10$, $p_c = 25{\cdot}50 \pm 0{\cdot}10$ normal atmosphere, $v_c = 0{\cdot}482$ litres/mol (4·22 ml/gm) $d_c = 2{\cdot}07$ mol/litre (0·237 g./ml). The uncertainty in the critical volume or density is 3%.

G. R. N.

81. Action of Sulphuric Acid on an Optically Active Hydrocarbon. R. L. Burwell, Jr., and G. S. Gordon. *J. Amer. chem. Soc.*, 1948, **70**, 3128.—(+)3-Methylheptane and 80 mol % sulphuric acid-d_2 have been agitated together at temperatures between 25° and 70° C. Exchange and racemization occur with the rate of the former being about fifteen times greater. Isomerization is slower than racemization. The rate of exchange of normal octane is more than 100 times slower than that of 2- and 3-methylheptane. These results are incompatible with those mechanisms of alkylation of olefins by *iso*paraffins which involve initial attack by sulphuric acid on the alkane. Possible mechanisms of the racemization–exchange reaction are discussed, with most favour being given to a chain reaction with an olefin intermediate.

G. R. N.

82. Exchange Reaction between Methane and Deuteromethanes on Silica-Alumina Cracking Catalysts. J. Parravano, E. F. Hammel, and H. S. Taylor. *J. Amer. chem. Soc.*, 1948, **70**, 2269.—This reaction occurs measurably at temperatures of 345° C and higher; the activation energy between 345° and 384° C is 13 k. cal. A mechanism for the cracking of hydrocarbons is postulated : scission of C–H bonds and then scission of C–C bonds. Ethylene hydrogenation takes place on the same catalyst in the same temperature range. G. R. N.

83. Relative Rates of Propylation of Monoalkylbenzenes. F. E. Condon. *J. Amer. chem. Soc.*, 1948, **70**, 2265.—The relative rates of propylation of benzene, toluene, ethylbenzene, cumene, and *tert.*-butylbenzine are 1, 2·1, 1·8, 1·7, and 1·4 respectively. Steric hindrance in the ortho positions increasing with the size of the alkyl group appears to be the principal cause of the difference in the rates. The alkylation catalyst was either boron fluoride etherate or nitromethane and aluminium chloride.

R N.

84. Isomerization of Certain Olefins by Silica Gel at Room Temperat
Gallaway and M. J. Murray. *J. Amer. chem. Soc.*, 1948, **70**, 2584.—At perature each of the 2 : 4 : 4-trimethyl pentenes is isomerized approx to equilibrium mixture of these olefins during passage through a silica-gel adsorption column. Under the same conditions 2-ethyl-1-hexene is almost completely isomerized, probably also to the equilibrium concentration. Olefins of the $RR'C = CH_2$ type which are present in thermally cracked gasoline are also isomerized. The isomerization of hexene-1 is not appreciable. Reduction of the temperature of the adsorption column to about −20° C nearly halts the isomerization of the olefins studied. G. R. N.

85. Vapour Pressure of Pentene-1. H. O. Day, D. E. Nicholson, and
J. Amer. chem. Soc., 1948, **70**, 1784.—The density of liquid pentene
pressure was determined from 0° to 50° C; the vapour pressure
between 0° and 200° C. The heats of vaporization were calculated

86. Kinetic Studies on the Formation of Polybutadiene. W. G
Winkler. *Canad. J. Res.*, 1948, **26**B (8), 564–580.—In the recovery of unreacted butadiene from the large-scale butadiene–styrene reaction an insoluble polybutadiene (I) is formed which may damage the distillation equipment. The object of the work described was to study the mechanism of formation and growth of this polymer with a view to the elimination of the nuisance.

The rate of growth of I is essentially the same in butadiene liq or vapour, is pro-

portional to the initial wt of seed used, and increases with increased active O_2 content of the seed and with increased temp. The inhibiting effect of various compounds was studied. It appears that the growth of I takes place by relatively slow reaction of monomer with free radicals formed by decomp of hydroperoxides in the seed.
D. F. J.

87. Vapour Pressure Studies in the System, Aluminium Bromide–Hydrogen Bromide–Paraffin Hydrocarbon. C. M. Fontana and R. J. Herold. *J. Amer. chem. Soc.*, 1948, **70**, 2881.—The solubilities of hydrogen bromide in normal butane and normal hexane and selected solutions of aluminium bromide in the same hydrocarbons have been determined. The solutions have been found to obey Henry's law over the pressure range 0–30 lb, absolute partial pressure of hydrogen bromide and in the temperature range 0–30° C. The evidence for the existence of the compound "$HAlBr_4$" was negative under the above conditions. G. R. N.

88. Spontaneous Ignition of Nickel Carbonyl Vapour. E. J. Badin, P. C. Hunter, and R. N. Pease. *J. Amer. chem. Soc.*, 1948, **70**, 2055.—Nickel-carbonyl vapour explodes in air or oxygen at 20° C and partial pressures as low as 15 mm. Explosion is preceded by a long and variable induction period. Addition of nickel carbonyl to a normal butane–oxygen mixture causes the latter to react at 20–40° C.
G. R. N.

89. Thermal Properties of Petroleum Oils, Effect of Pressure on Enthalpy of Petroleum Vapour. (III). M. Van Winkle. *Refiner*, Aug. 1948, **27** (8), 435.—A method for determining the effect of pressure on the enthalpy of petroleum vapour is described. Charts are given which relate true and pseudo critical temperatures and pseudo critical pressures to the 100% flash vaporization temperature, and the slope of the flash curve. The enthalpy correction for pressure effect is expressed graphically in terms of reduced temperature and ratio of enthalpy correction to reduced pressure at constant absolute pressure. H. A. C.

90. Absorption Spectra of Phenylated Anthracenes. Y. Hirshberg. *Trans. Faraday Soc.*, 1948, **44**, 285–289.—U.V. absorption curves are shown of 9-phenylanthracene, 9-10 diphenylanthracene, 1-phenylanthracene, 1-4 diphenylanthracene, 2-phenylanthracene, 2-9 diphenylanthracene, 1 : 4 : 9 : 10-tetraphenylanthracene and 1 : 4 : 5 : 8 tetraphenylanthracene and compared with the corresponding curve for anthracene. The effect of the position of substitution and accumulation of phenyl groups on the absorption spectra is discussed. E. B.

91. Interpretation of the Viscosity of Liquids. R. C. L. Bosworth. *Trans. Faraday Soc.*, 1948, **44**, 308–317.—The expression $\eta = 1{\cdot}047\left[\frac{RT}{V}\frac{\lambda_t}{C_1}\right]$ is derived for viscosity of a liquid where V is the mol. vol., λ_t the mean free path of phonons (assumed to be carriers of momentum—Einstein and Debye theories of sp. ht.) and C_1 is velocity of sound in the liquid. The equation

$$\eta = 1{\cdot}75 \times 10^{-7}\frac{M^{5/6}}{T^{1/2}\rho^{1/3}\beta_s}$$

is derived on the assumption that λ_t is a measure of the mean distance from any molecule in the liquid to a "hole" in the lattice, M = mol. wt., ρ = density, β_s = compressibility. Agreement between experimental data and theory is good.
E. B

Analysis and Testing.

92. Bleeding Tendency of Petrolatum. A. Kinsel and J. Phillips. *Refiner*, Aug. 1948, **27** (8), 428.—An attempt has been made to define the quality of petrolatum by a test other than the normal ones of melting point, consistency, viscosity, and colour. The proposed test is one which evaluates the tendency to bleed or stain. The sample is placed on a filter paper; after 24 hr the excess oil in the sample will have formed a ring the diameter of which is measured and subtracted from the diameter of the

initial sample, the difference in mm is designated as the bleeding number. Under controlled conditions the test is reproducible. H. A. C.

93. Electron Microscopy Application and Use in Petroleum Industry. S. G. Ellis. *Refiner*, Aug. 1948, **27** (8), 410.—This first article deals with the construction, use, and maintenance of the electron microscope. The author points out that the main use of this instrument is in studying details in specimens of the order of 2000 Å. to 10 Å. which cannot be observed with a light microscope. This range includes many powders, colloids, and catalysts which are of industrial importance. The problem of specimen preparation and mounting is discussed, this being of great importance if all the details are to be revealed. The thickness of the specimen is usually less than 1 μ; suitable films on to which specimens may be mounted are given. The interpretation of the electron micrographs requires some experience, as confusion may be caused by the relatively great depth of focus of this instrument. Calibration can be accomplished by using replicas of diffraction gratings. Auxiliary techniques, such as shadow casting and staining, which increase contrast are described. An extensive bibliography is quoted. H. A. C.

94. Oil Industry Uses for Electron Microscopy (II). S. G. Ellis. *Refiner*, Sept. 1948, **27** (21), 487.—This second article deals with the application of the electron microscope, and examples of its use are given. This instrument has proved useful in the study of soaps which control the properties of greases; electron micrographs of calcium- and sodium-base soaps are reproduced. The methods of specimen mounting, both for direct and shadow micrographs, are described. Work which has been done relating the change of structure of such soaps with shear is outlined. Other electron micrographs in the text are of various catalyst structures, and more detail of the specimen-mounting technique required to take these is given. The use of the electron-diffraction method is also outlined. H. A. C.

95. The Flash Test. A. W. Trusty. *Refiner*, Sept. 1948, **27** (9), 471.—A survey is made of the historical methods of flash tests, and descriptions of use and photographs of modern equipment used in this country and abroad are given. The significance of flash tests is discussed in relation to fire hazard and to the volatility and type of lub. oils. H. A. C.

96. Determination of Olefins in Cracked Gases. G. E. Mapstone and P. Beckman. *Refiner*, Aug. 1948, **27** (8), 442.—The most common method is to use caustic potash solution to absorb acid gases, 87% sulphuric acid to absorb higher olefins, and bromine water followed by caustic potash or sodium sulphite to remove residual olefins. The authors report that trouble is caused by the absorption of butane in 87% sulphuric acid, which gives incorrect results for higher olefin content. They propose an alternative method of determining this figure by first obtaining the percentage of total olefin by absorption in mercuric-sulphate–sulphuric-acid reagent, and subtracting from it the ethylene content obtained by the former method. H. A. C.

97. Evaluation of the Oxidation Sensitivity of Lubricating Oils. H. P. Fiedler. *Erdöl u. Kohle*, 1948, **1**, 39–42.—Tendency of lub. oils to oxidize can be rapidly detected by exposure to U.V. irradiation under controlled conditions (30° C, 2 hr), withdrawing samples periodically (every 15 min) and determining peroxide val, acidity, and visc. The peroxide val is the most indicative of these tests, and the effect on oxidn of cat (*e.g.*, Ni) or inhibitors (*e.g.*, butylamine) is clearly discernible by this test. A method for the determination of peroxide val is described, based on the procedure of Stansby (*Industr. Engng Chem. Anal.*, 1941, **13**, 627). Test results on a synthetic lub. oil (ester type) gave peroxide val (millimol O_2/kg oil) in the region of 20 after 2 hr exposure. Measurement of the iodine val of the oil before and after the test gives valuable additional indications. V. B.

98. A New Method for the Rapid Titrimetric Analysis of Sodium Alkyl Sulphates and Related Compounds. S. R. Epton. *Trans. Faraday Soc.*, 1948, **44**, 226–230.—See Abstract No. 451 (1948).

Gas.

99. Natural Gas Processing Units on Upgrade, with 107 Projects in Active Status. R. B. Tuttle. *Oil Gas J.*, 4.11.48, **47** (27), 88.—Lists show natural-gas-processing plant projects in the U.S.A., over 40% of which are either building or authorized new plant construction, together with plant projects completed in second and third quarter of 1948, which latter includes eight new plants. G. A. C.

Engine Fuels.

100. Diesel Fuel Additives. M. Smolak and F. L. Nelson. *Refiner*, Aug. 1948, **27** (8), 405.—This article is a report on a series of tests carried out by Socony Vacuum in an attempt to find an additive to diesel fuels which will aid cold starting. The tests were carried out for 1 min at constant cranking speed of 180 ± 10 r.p.m. in a cold room in which atmospheric conditions from 0° to 80° F could be reproduced.

Fuels without additives were first run, and it was found that a Cetane No. increase of 10 will effect about a 12° F reduction in minimum starting temperatures, the curve levelling off at 60 Cetane No. to a minimum of 15° F. The effect of addition of various ignition promoters shows that normal additives, *e.g.*, *t*-butyl hydroperoxide, cumene hydroperoxide, and nitrated compounds such as *n*-butyl nitrate, which increase Cetane No. appreciably have very little effect on starting characteristics. Addition of volatile liquids such as *n*-heptane, ethyl ether, etc., appreciably decreased the starting temperatures; the effect is not purely one of volatility as shown by the effect of adding *iso*-octane which raises the starting temperature. Various miscellaneous organic compounds mainly of a glycerol type have been tried, the most effective being diethylene glycol diethyl ether.

The general conclusion reached is that the expenditure of effort necessary to find a dope which would be effective in concentrations of 0·2–1·0% is unattractive, especially when it is considered that vaporization of starting acids such as ethyl ether in the induction air system will reduce starting temperature to about −40° F.

H. A. C.

101. Motor Gasoline from Middle East Crude. C. V. Hill, H. T. Lorne, and A. R. Mercer. *World Petrol.*, 1948, **19** (11), 52–55.—The S.R. gasolines are characterized by relatively low O.N. and generally high S content. Middle dist are high grade, and production is usually kept at max. Sweetening and cat desulphurization are applied to the S.R. gasolines, and upgrading processes such as thermal reforming and hydroforming utilized. Data are presented of yield–octane–T.E.L. relationships for sweetened, desulphurized Iranian S.R. gasolines and for the combined processes of reforming and cat desulphurization; reforming and sweetening; reforming and cat polymerization and finally hydroforming and cat desulphurization. Max yield of S.R. gasolines is 27·9% vol on crude when making max middle dist. Losses entailed in upgrading processes can be balanced by cat cracking (synthetic cat and 50% conversion) of the waxy dist with b.p. >660° F. Improved fuel oil is simultaneously produced. Tests on numerous gasoline blends are given. E. B.

102. Catalytic Treatment of Synthetic Gasoline. C. J. Helmers, A. Clark, and R. C. Alden. *Oil Gas J.*, 28.10.48, **47** (26), 86.—Gasoline produced from carbon monoxide and hydrogen by modifications of the Fischer–Tropsch process, in the presence of an iron catalyst, has oxygen-containing compounds present as impurities in far higher proportions than in gasoline produced from crude oil. The compounds comprise a mixture of alcohols, aldehydes, ketones, esters, and acids, and must be removed from synthetic naphtha as they contribute to poor odour, colour, and gum-stability characteristics.

The Perco catalytic-desulphurization process causes isomerization of some of the olefins present and thus up-grades synthetic gasolines. Debutanized and cut to end point synthetic effluent was treated at low-temperature over bauxite catalyst, again debutanized and re-run to end point. The vapour pressure was raised by blending-in poly gasoline and butane so that the finished gasoline reached 80 to 90 research O.N.

The effect of temperature and rate of flow in the Perco treatment was studied.

Increase of treating temperature from 750° to 850° F and doubling the flow rate gives practically the same octane improvement, though the high-temperature treatment gives a slightly less gasoline yield, with gas formation.

If the gasoline is inhibited with a commercial antioxidant (5 lb/1000 brl gasoline) the vapour-phase treatment results in improved octane rating, colour, odour, and gum characteristics, the product also having an excellent induction period for a highly olefinic gasoline.

The principal reaction following the Perco treatment must be due to change in molecular structure of the olefin hydrocarbons.

Six tables and one figure illustrate the article. G. A. C.

103. Sulphur Compounds in Gasoline. A. Fookson and A. D. Bell. *Refiner*, Sept. 1948, **27** (9.1), 459.—The problem of sulphur content is becoming increasingly serious due to the depletion during the war of crude oils low in sulphur; consideration must be given to the utilization of reserves much of which have a high sulphur content. Major objections to the presence of sulphur in gasoline are that the oxidation products are corrosive and the O.N. and lead response are adversely affected. The various sulphur compounds which may be present are listed, and methods of analysis for both total sulphur and the different sulphur compounds are described.

An equation is given relating the reduction of lead response to the amounts of sulphur compounds present in the gasoline. Engine wear is directly related to the sulphur content, but can be limited if engine temperatures are kept high and the crankcase ventilated. Wear is said to be due to the presence of sulphur trioxide. A very extensive bibliography relating to this problem is given. H. A. C.

104. Use of Anti-Detonant Injection in a High Compression Ratio Engine. R. I. Potter. *Refiner*, Sept. 1948, **27** (9.1), 497.—Owing to the greater efficiency of high-compression-ratio engines their use in automobiles is becoming of greater importance. Three methods of supplying fuel to these engines are outlined in this paper; a single high-octane fuel system which has the advantage of simplicity but uses more high-octane fuel than is necessary; a double-fuel system in which high-octane fuel is only supplied when required by high engine loading; and thirdly a single fuel system using premier grade gasoline 85–90 O.N. in conjunction with anti-detonant injection, which will bring the rating up to 100 or greater, when required. The results of work carried out on this latter method are given.

A standard six-cylinder engine which was converted to a 9 : 1 compression ratio by altering the piston design was used in the experiments, both on a test bed and on road tests. An increase of 20·1% in m.p.g. is reported for the high-compression-ratio engine compared to the standard engine. The consumption of anti-detonant was 220 m.p.g. to obtain this increase of efficiency. The anti-detonant used in these experiments was 85 : 15 alcohol–water solution plus 3 cc of T.E.L. per gallon, and when necessary due to high engine loading the solution was added to air–fuel mixture supplied by the standard carburettor. H. A. C.

105. A Study of the Pro-knock Activity of Various Substances. J. D. B. Ogilvie, S. G. Davis, A. L. Thompson, W. T. Grummitt, and C. A. Winkler. *Canad. J. Res.*, 1948, **26F** (6), 246–263.—Compounds which gave indications of pro-knock activity in a 1933 model Chevrolet engine were investigated quantitatively in an Ethyl Knock Testing Engine, Type 30B. The methods of introducing the solid, liq, and gaseous pro-knock compounds into the air stream are described.

Pro-knock compounds are of two main types, (*a*) those which counteract the effect of any anti-knock present, and (*b*) those which, in addition, have some effect on the gasoline. A long chain and an asymmetric molecule are effective pro-knock structures, and halogens, nitrites, nitro-compounds, and elements of Group V increase the effectiveness. Compounds of type (*a*) showed greatest effect in fuels of high lead susceptibility brought up to a high O.N. with T.E.L. from a low-octane base stock. They were similarly effective in counteracting iron carbonyl, but had no effect on aniline. Compounds of type (*b*), however, counteracted aniline, and when added to diesel fuels showed a marked increase in Cetane No. Twenty references.

D. F. J.

106. Oxidation, Ignition, and Detonation of Fuel Vapours and Gases. V. The Hydrogen Engine and the Nuclear Theory of Ignition.—R. O. King, W. A. Wallace, and B. Mahapatra. *Canad. J. Res.*, 1948, **26F** (6), 264–276.—According to the nuclear theory of ignition stated in Part IV (see Abstract No. 1690, (1948)) it should not be possible to ignite a gaseous combustible mixture by any method of heating if it remains truly homogeneous. In an engine such mixtures cease to be homogeneous when heated by compression because of the formation of finely divided carbon by pyrolysis of lub. oil or of hydrocarbon vapour. Ignition due to this finely divided carbon is demonstrated by experiments burning H_2 in a CFR engine. When the engine in normal condition was run on H_2, pre-ignition and severe knocking were obtained, and it was impossible to use any but weak mixtures even at low C.R.s. When, however, the combustion space was maintained clear of fluffy carbon, H_2 could be used at C.R.s up to 10 : 1, this being the max attainable C.R. of the engine, and at any mixture strength. When C dust was admitted with the combustible mixture, pre-ignition and combustion knock reappeared. D. F. J.

107. Oxidation, Ignition, and Detonation of Fuel Vapours and Gases. VI. The Prevention of Pre-ignition and Detonation in Gas Engines. R. O. King, W. A. Wallace, and B. Mahapatra. *Canad. J. Res.*, 1948, **26F** (9), 366–373.—Further confirmatory evidence for the nuclear theory of ignition (see Abstract No. 1690, (1948)) is produced. Town gas containing H_2 in large concn can be used as fuel for a carburettor-type Otto-cycle engine at C.R.s rising to 10 : 1 and in mixtures of any strength provided that accumulation of fluffy carbon is prevented. Data is given for the variation of power and economy with mixture strength and ignition timing at C.R.s of 6, 8, and 10 : 1. D. F. J.

108. Patents. Ethyl Corporation. B.P. 600,187, 14.4.48. Anti-knock agents.

A. Duckham & Co. Ltd. and A. C. Pepper. B.P. 600,191, 14.4.48. Fuels used in I.C. engines.

J. C. Arnold (Standard Oil Development Co.). B.P. 600,367, 21.4.48. Fuels for diesel and like engines.

J. C. Arnold (Standard Oil Development Co.). B.P. 600,471, 21.4.48. Production of aviation gasoline.

Anglo-Iranian Oil Co. Ltd., D. A. Howes, T. Tait, W. A. Partridge, P. Docksey, and S. F. Birch, B.P. 600,551, 28.4.48. Aviation or motor fuels.

Texaco Development Corpn. B.P. 601,009, 5.5.48. Aviation fuels. G. R. N.

Gas Oil and Fuel Oil.

109. Refractories for Oilheating. C. H. Burkhardt. *Fuel Oil & Oil Heat*, Oct. 1948, **7** (6), 61.—One of the most important conditions to be complied with in order to obtain complete and clean combustion with domestic oil burners is the proper material surfaces surrounding the flame. This is particularly important at the beginning of each cycle, where the flame is at its lowest efficiency. An oil-burner flame depends upon high surrounding temperatures for its efficient operation, particularly at low flow rates, and the refractory material for small fires must absorb and pass on to outer surrounding surface as little heat as possible.

An insulating-type firebrick of cellular structure and, therefore, porous and light in weight is essential to clean starting combustion. This is particularly true for rates of flow of 1½ g.p.h., or less, and where there are short on-and-off firing cycles. Heavy bricks are unsuitable as they permit heat transfer and take too long to come to a heat balance with the adjacent flame.

The use of heavy brick and method of its application is described.

The author outlines the basic requirements of firebricks and deals in some length with their characteristics. C. D. B.

110. Burner Testing Studies. B. R. Walsh. *Fuel Oil & Oil Heat*, Oct. 1948, **7** (6), 55.—Early in 1946 Gulf Research & Development Company initiated a programme of fuel-oil tests in their laboratory to study cat-cracked fuel oils, in order to establish

suitable control specifications that would ensure the continuous supply of maximum-burning-quality oil for all types of oil burners. Work was carried out on rotary wall flame, high-pressure gun, low-pressure gun, and space-type burners, with the object of analysing the burning and stability characteristics of various fuel oils, the development of operation and adjustment data for use of service personnel, and the study of burner-design improvements.

The programme covered starting, and smoke and soot, as determined by burner tests and, in addition, oxidation stability in storage, sedimentation, corrosion, and odour.

Some of the results obtained in these studies are described. Amongst other things it was found that soot deposits from some cat-cracked fuels were resinous, as opposed to the fluffy, loosely deposited soot of straight-run oil with a correspondingly higher heat conductivity and less heat loss, and that combustion factors effecting smoke formation were similar to those obtaining in the diesel engine. C. D. B.

Lubricants.

111. Ring Analysis of the Edeleanu Extract from Baicoi Lubricating Oil. V. Vantu and M. Gavat. *Bull. Inst. Nat. Recherches Tech. Roumanie*, 1948, **3**, 242–249.—Dewaxed Edeleanu extract (E_{100} 4·8°, acidity 6·46, sulphur 0·84%, wax 10·6%) was fractionated using superheated steam (180–200° C) and a vac of 20 mm, to yield 47% distillate, from which two further cuts were obtained by redist. The bulk fraction and the two cuts had the following respective characteristics: d_4^{20} 0·990, 0·943, 0·980; V.I. −83, −4, −212; visc at 38° C 1693, 104, 1864 cs; mol. wt. 350, 278, 399; aromatics 47, 33, 40%; naphthenes 27, 11, 26%; paraffins 26, 55, 33%. The distribution of hydrocarbon groups was obtained by Waterman ring-analysis. The results show that an Edeleanu extract contains an appreciable proportion of hydrocarbons other than aromatics; the selectivity of sulphur dioxide is thus not adequate to prevent the removal of compounds having lubricating properties. V. B.

112. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 600,325, 21.4.48. Fluid lubricant.

Youngstown Miller Co. B.P. 600,332, 21.4.48. Method and apparatus for oil purification.

Standard Oil Development Co. and C. Arnold. B.P. 600,361, 21.4.48. Lubricating grease composition.

J. B. Calva. B.P. 600,420, 21.4.48. Lubricating and penetrating oil.

A. H. Stevens (Emery Industries Inc.). B.P. 601,120, 12.5.48. Methods for making lubricating grease.

C. Arnold (Standard Oil Development Co.). B.P. 601,258, 12.5.48. Polymerization products particularly for use as lub.-oil additives.

Texaco Development Corpn. B.P. 601,346, 20.5.48. Method of preparing lithium base lubricating grease.

J. C. Arnold (Standard Oil Development Co.). B.P. 602,239, 2.6.48. Lubricants, waxes, and other hydrocarbon or substituted hydrocarbon products.

C. Arnold (Standard Oil Development Co.). B.P. 603,967, 7.7.48. Lubricating-grease composition.

Monsanto Chemical Co. Ltd. B.P. 604,370 and 604,388, 14.7.48. Extreme pressure lub.-oil compositions.

Bataafsche Petroleum Mij. B.P. 606,319, 25.8.48. Process for the manufacture of a product suitable for use as a lubricant or as an addition to a lubricant.

J. C. Arnold (Standard Oil Development Co.). B.P. 607,695, 15.9.48. Lubricant.

Bataafsche Petroleum Mij. B.P. 607,757, 15.9.48. The preparation of lubricants.

Bataafsche Petroleum Mij. and J. J. Frewing. B.P. 607,996, 22.9.48. Lubricating compositions. G. R. N.

Bitumen, Asphalt, and Tar.

113. Laboratory Study of the Hot-water Process for Separating Hydrocarbons from Surface Deposits of Bituminous Sandstones near Edna, Calif. G. B. Shea and R. V. Higgins. *U.S. Bur. Mines Rep. Invest.* 4246, Oct. 1948, 31 pp.—War demands warranted the study of utilizing the outcropping bituminous sandstones in California, and the Edna deposit was selected for laboratory investigation. Considerable progress was made in developing a process for the hot-water separation of bitumen.

A laboratory plant capable of dealing with 25 lb sandstone per hour was designed and is illustrated. Recovery of bitumen was 95% of the original content, and represented 24·7 gal/ton of sandstone. Analyses of the bitumen are given, the average products from cracking at 823° F for 867 sec being gasoline and naphtha, 17·1%; gas oil, 20·3%; lubricating distillate, 21%; residuum, 39·6%. Properties of asphalts from the sandstone are also given, as are details of the testing methods used on the sandstone. G. S.

114. Patents. International Bitumen Emulsions Ltd. and P. Ellis. B.P. 600,009, 14.4.48. Construction of floors, roofs, and walls.

Soc. Anon des Mines de Bitume et d'Asphalte. B.P. 600,288, 14.4.48. Methods and apparatus for spreading viscid or pulverized materials on to roads and pavements.

International Bitumen Emulsions Ltd., R. M. Kerry and A. E. T. Lawrence. B.P. 600,407, 21.4.48. Bonding laminates.

Huiles, Goudrons et Derives and N. Bairlle. B.P. 600,685, 28.4.48. Method and plant for continuously cooling and solidifying pitch, bitumen, asphalt, and resins.

Low Temperature Carbonization Ltd., G. S. Pound, and S. R. M. Ellis. B.P. 601,904–5, 26.5.48. Production and manufacture of resinous products from phenolic oils and of synthetic bitumens.

Bataafsche Petroleum Mij. B.P. 602,582, 9.6.48. Process for mixing a high-molecular substance with asphaltic bitumen or pitch.

Bataafsche Petroleum Mij. B.P. 604,408, 14.7.48. Process for improving the properties of bitumens.

International Bitumen Emulsions and W. C. Gardner. B.P. 605,057, 28.7.48. Waterproof compositions.

Bataafsche Petroleum Mij. B.P. 606,486, 25.8.48. Manufacture of road compositions.

Bataafsche Petroleum Mij. B.P. 606,575, 1.9.48. Process for joining together asphaltic bitumens with different penetration indices.

Bataafsche Petroleum Mij. B.P. 608,076, 22.9.48. Manufacture of asphaltic bitumens.

R. D. Swan. B.P. 608,286, 22.9.48. Bituminous compositions.

Bataafsche Petroleum Mij. B.P. 608,394, 29.9.48. Preparation of asphaltic bitumen compositions. G. R. N.

Special Hydrocarbon Products.

115. Catalytic Dehydrogenation of Ethylbenzene. R. R. Denner and E. C. Dybdal. *Chem. Engng Prog.*, Apr. 1948, **44** (4), 275.—In production of synthetic rubber the dehydrogenation of ethylbenzene to styrene is an important reaction. This operation can be carried out thermally or catalytically.

In the latter case the catalysts can be divided into three types: (1) those dealing with undiluted hydrocarbon vapour and requiring frequent regeneration: (2) those operating in presence of steam but requiring frequent regeneration: (3) the self or continuously regenerating type operating in presence of steam, which bring about the regeneration.

This article deals with a thermodynamic investigation carried out to obtain correlated rate data in connexion with types (1) and (3) to allow the design of efficient convertor systems. O. M.

Derived Chemical Products.

116. Patent. J. C. Arnold (Standard Oil Development Co.). B.P. 600,825, 5.5.48. Preparation of alkaline-earth metal salts of alkyl phenol sulphides. G. R. N.

Coal, Shale, and Peat.

117. Patent. Standard Oil Development Co. B.P. 602,376, 9.6.48. Distillation of mixtures of coal and hydrocarbon oil. G. R. N.

Miscellaneous Products.

118. Antifreeze Properties of Tetrahydrofurfuryl Alcohol and Anhydrous Glycol Solutions. K. A. Clendenning. *Canad. J. Res.*, 1948, **26**F (5), 209–220.—Concerned with the usefulness of tetrahydrofurfuryl alcohol (I) as an antifreeze when used alone, and when mixed with water or with anhydrous glycols of low mol. wt. A series of anhydrous glycol mixtures was also investigated with respect to f.p. and visc at low temps.

Aqueous solutions of I exhibit maxima in sp. gr. and visc at solute concns of 80–90 wt.-%, but do not distil azeotropically. In the presence of 0–20% water, I remains mobile at −75° C. The low sp. ht. of I and its deteriorative effects on rubber are unfavourable characteristics of the anhydrous liq, but only small differences between I and ethylene glycol were shown by radiator-hose connexions after lengthy immersion and driving tests. I is also almost equiv to ethylene glycol with respect to stability, permanence, thermal expansion, inflammability, surface tension, and corrosivity.

Of the six binary glycol solutions studied at 50% concn, ethylene glycol–trimethylene glycol is the least viscous. D. F. J.

119. Concentrated Solution Viscosity of GR–S : Its Variation (in Benzene) with Temperature and Concentration. L. H. Cragg, L. M. Faichney, and H. F. Olds. *Canad. J. Res.*, 1948, **26**B (8), 551–563.—Measurements of the visc of solutions of GR–S in benzene have been made at very low rates of shear by means of a falling-ball viscometer. Determinations were made at temps 10–35° C and with solutions of concns (C_w) 10–19 wt.-%. The visc is given by

$$\eta \text{ (poise)} = 4{\cdot}53 \times 10^{-4} \exp.\left[\left(0{\cdot}815 + \frac{656}{T}\right) C_w^{\frac{1}{2}}\right]$$

Extrapolation, using this equation, to 100% polymer gives 13·0 k. cal/mole for the energy of activation of flow of GR–S. Indications are that the flow behaviour of GR–S is much the same in or out of (conc) solution. D. F. J.

120. Patents. Shell Development Co. B.P. 600,693, 28.4.48. Foam-reducing compositions and methods of producing same.

Shell Development Co. B.P. 600,948, 5.5.48. Resin-bonded, moulded, or shaped articles and their preparation.

J. C. Arnold (Standard Oil Development Co.). B.P. 601,224, 12.5.48. Manufacture of hydrocarbon copolymers.

J. C. Arnold (Standard Oil Development Co.). B.P. 601,226, 12.5.48. Manufacture of polymeric materials.

J. C. Arnold (Standard Oil Development Co.). B.P. 601,317, 20.5.48. Production of rubber-like copolymers.

Shell Development Co. B.P. 601,456, 20.5.48. Fungicide and bactericide.

C. Arnold (Standard Oil Development Co.). B.P. 601,472, 20.5.48. Treatment of cyclic acetals for the production of glycols.

J. C. Arnold (Standard Oil Development Co.). B.P. 601,479, 20.5.48. Production of plasticized rubber-like polymers.

Standard Oil Development Co. B.P. 601,587, 20.5.48. Process for the manufacture of rubber-like polymeric materials.

Shell Development Co. B.P. 603,636, 30.6.48. Composition for treating soil.

Shell Development Co. B.P. 603,809–10, 7.7.48. Production of unsaturated halogenated hydrocarbons and hydrolysis of acetone auto-condensation products.

Shell Development Co. B.P. 604,284, 14.7.48. Process for polymerizing esters of unsaturated alcohols.

Shell Development Co. B.P. 604,403, 21.7.48. Emulsifiable hydrocarbon oils and emulsions thereof.

Bataafsche Petroleum Mij. B.P. 604,412, 14.7.48. Manufacture of copolymers from vinyl esters and vinyledene compounds by emulsion polymerization.

Shell Development Co. B.P. 604,544, 21.7.48. Process for polymerization of unsaturated organic compounds.

J. C. Arnold (Standard Oil Development Co.). B.P. 604,860, 21.7.48. Slushing composition.

Bataafsche Petroleum Mij. B.P. 605,516, 5.8.48. Process for the emulsion polymerization of vinyl halides.

Bataafsche Petroleum Mij. B.P. 605,517, 5.8.48. Process for the manufacture of co-polymerization products.

Shell Development Co. B.P. 605,573, 11.8.48. Plasticized organic compositions.

Bataafsche Petroleum Mij. B.P. 605,606, 11.8.48. Process for the manufacture of polymerization products from vinyl chloride.

Anglo-Iranian Oil Co. Ltd., E. W. M. Fawcett and A. Millien. B.P. 606,099, 18.8.48. Production of plastic compositions containing polymers or copolymers of vinyl chloride.

Anglo-Iranian Oil Co. Ltd., E. W. M. Fawcett and E. S. Narracott. B.P. 606,416, 25.8.48. Production of plastic compositions.

Shell Development Co. B.P. 606,697, 1.9.48. Process for the production of resin-coated articles.

Bataafsche Petroleum Mij. B.P. 607,831, 15.9.48. Production of di*iso*propyl salicylic acid and its salts. G. R. N.

Engines and Automotive Equipment.

121. Road Vehicle C.I. Engines, Part I—Reflections upon Utilization Tendencies and Design Trends Revealed at the Commercial Motor Show. Anon. *Oil Engine & Gas Turbine*, Oct. 1948, **16** (186), 188.—The 14th International Commercial Motor Transport Exhibition is reviewed from the oil-engine angle. Analysis shows that 53% of the chassis for vehicles were fitted with oil engines, as compared with 22% in 1937. In other respects the survey is general, but does show the broad trend towards higher powers for double-decker passenger vehicles.

Although not comprehensive, the more outstanding examples of engines are described and their outputs quoted, and particular reference is made to the Foden six-cylinder two-stroke engine and the Sentinel horizontal models. C. D. B.

122. British Road Transport Oil Engines. Anon. *Gas Oil Pwr*, 1948, **43**, 291–297.—This review of the latest models and features of present-day practice includes a table giving the number of cylinders, capacity, bore and stroke, top service b.h.p. and r.p.m., specific fuel consumption, maximum torque, and corresponding speed for twenty-nine engines. Of these two are pressure-charged, and all except four have direct injection. During the last decade the output per litre of swept volume has remained almost the same, but since speeds have decreased to below 2000 r.p.m. the b.m.p. values have gone up. Other improvements have included better combustion characteristics and improved metallurgy. Greater attention is now paid to lubrication and oil-filtering systems.

Detailed descriptions are given of the Foden, Bristol, Daimler, and Albion engines. Five photographs and three line diagrams illustrate the article. H. C. E.

123. Caterpillar Announce New Engines. Anon. *Diesel Power Diesel Transportation*, Sept. 1948, **26** (9), 56.—Four new Caterpillar diesel engines, each having bore and stroke of 5¼ in × 8 in and a full-load speed run of 800–1200 r.p.m., are announced. The engines are of eight- and twelve-cylinder design with a 60 degree " V " arrangement having a range of continuous output of from 214 to 400 h.p. and a maximum output of from 267 to 500 h.p. The higher powered unit in both V. 12 and V. 8 versions is supercharged, and maximum power may be taken off at either end of the engine.

The design, a feature of which is interchangeability of parts between engines, is fully described. C. D. B.

124. New Large Diesel Tractor. Anon. *Gas Oil Pwr*, 1948, **43**, 308.—The Allis-Chalmers H.D. 19 diesel tractor incorporates a three-stage hydraulic torque converter, which is claimed to provide maximum torque under all conditions. The torque converter also protects the machine by absorbing transmission shocks. The tractor is powered by a General Motors' 6–71 type of two-stroke engine developing 163 b.h.p. at 1750 r.p.m. The six cylinders are each of 4¼ in bore and 5 in stroke. Throughout the machine wick-feed lubrication is employed. H. C. E.

125. Rockets and Ram Jets. E. Eltham. *World Petrol.*, Oct. 1948, **19** (11), 58.—The importance of rockets lies in their characteristic of delivering a great deal of power in a short time. This has important applications in aviation, in overcoming the " sonic barrier " and in taking off under heavy load, or in a short distance. Rockets may be of liquid- or solid-fuel types and must carry their own oxygen supply. Both types are in commercial or experimental use. The solid-fuel type consists of a steel cylinder 10-in dia., 3 ft long, with a nozzle safety device and ignition mechanism. The cylinder is packed with a propellant mixture solidified with asphalt. Rated thrust is 1000 lb lasting for 12 sec.

Liquid-fuel types require fuel–oxygen proportions to be carefully controlled, which is a major technical difficulty. The high temperatures attained in the combustion chamber also create difficulties.

Desirable characteristics for a fuel are high thrust per pound of propellant, high density, and low heat of formation. Most promising fuels under these considerations are hydrozines or organic amines.

The simple ram jet will probably become of great commercial importance when more is known of the principles of design. At present fuel consumption is high, the specific fuel consumption decreasing with velocity. Since the ram jet is not self starting, rockets must be used to attain velocities at which combustion is self-sustaining, and the ram jet then used at the higher velocities when efficiency is reasonably high. C. G. W.

126. Anticipating Engine Troubles by Oil Analysis. Anon. *Diesel Pwr Diesel Transportation*, Sept. 1948, **26** (9), 68.—The engine operator is interested in two things with regard to oil: first, should the oil be continued in service and, secondly, what can the condition of the oil tell him about the functioning of his engine. The article suggests those factors in oil analysis which can be interpreted by the operator with these objects in view, shows how these factors may be applied and interpreted, and gives several instances of actual experience in this connexion. C. D. B.

127. Progress in Lubricant Filtration. Anon. *Oil Engine & Gas Turbine*, Oct. 1948, **16** (186), 194.—A new lub.-oil filter known as the Purcolator Micronic oil filter is described, and graphs showing its performance relative to a conventional felt-type filter given. The Micronic filter has been designed to remove abrasive particles down to 1 μ and may be used as a by-pass or full-flow unit. It is suitable for use with high-duty type oils.

The filter consists of a plastic element which is heat-resistant, waterproof, and warp-proof. It is 10 ft long and pleated in accordion fashion into a cylindrical element 3·1/8 in diameter and 4 in high, giving a filtering surface of approximately 500 sq. in. As foreign matter is retained on the surface it is claimed to be more effective and to have longer life than conventional types. C. D. B.

128. Water-cooled Manifolds. Anon. *Gas Oil Pwr*, 1948, **43**, 304.—Experiments were carried out on a Superior eight-cylinder four-stroke turbo pressure-charged

engine set to give a nominal top output of 1160 b.h.p. at 325 r.p.m. Water-cooling of the manifold did not affect the specific fuel consumption or the exhaust-gas pressure. By using a water-cooled manifold equal power could be obtained with lower exhaust gas temperature at the turbine, lower pressure-charger speed, and lower charging-air pressure. H. C. E.

129. Patents. Anglo-Saxon Petroleum Co. Ltd., P. G. Pigneguy and D. M. Clement. B.P. 601,234, 12.5.48. Apparatus for the detection and measurement of knock in I.C. engines.

Anglo-Saxon Petroleum Co. Ltd., and I. Lubbock. B.P. 602,149, 2.6.48. Combustion chamber linings.

Shell Development Co. B.P. 606,451, 25.8.48. Fuel-control system for I.C. engines.

Thompson Products Inc. B.P. 607,876, 22.9.48. Fuel control for I.C. engines.

G. L. Martin Co. B.P. 608,215, 22.9.48. Lubricating systems and methods of controlling the temperature and flow of the lubricant therein.

Shell Development Co. B.P. 608,483, 29.9.48. I.C. engine fuel-regulating systems. G. R. N.

MISCELLANEOUS.

130. France Leads in Foreign Refinery Capacity Increases. Anon. *Oil Gas J.*, 4.11.48, **47** (27), 85.—Refinery expansion outside the U.S.A. is listed for countries including South America, Australia, Europe, Middle East, East and West Indies, Mexico, Gt. Britain, and Canary Isles.

Projects total seventy-four, and it is shown that France leads with seven projects of total capacity of 133,000 b.d. List shows capacity and status. G. A. C.

131. Domestic Refinery Capacity to Total 6·4 Million b.d. by early 1949. R. B. Tuttle. *Oil Gas J.*, 4.11.48, **47** (27), 75.—Refining and petrochemical plant projects in the U.S.A. numbering 171 are listed, together with projects completed in second and third quarters of 1948.

An increase of 150,000 b.d. of additional crude-oil charging capacity brings the U.S. total refining capacity to 6·25 million b.d.; and by third quarter of 1949 capacity should be 6·6 millions.

The list shows capacity rating, status, completion date, and contractors. G. A. C.

132. Progress in Metals. W. L. Nelson. *Oil Gas J.*, 7.10.48, **47** (23), 269.—Two slightly different codes for naming aluminium and magnesium alloys are dealt with. Letters are used in two ways, depending on whether alloys are present or not. Numbers after letters are also used in two ways, one to give nominal percentage of each of the elements, the other to indicate number of alloy elements. Examples are provided; and metallurgical terms defined. G. A. C.

133. Steel Embrittlement in Caustic Treating Service. E. L. Hildebrand. *Oil Gas J.*, 7.10.48, **47** (23), 271.—Causes of failures of low-carbon-steel equipment in caustic service have been found to be a combination of three basic factors—a concentrated alkaline solution, high metal stresses, and elevated temperatures.

Embrittlement cracks are of two types: (1) boiler and (2) caustic embrittlement. Boiler embrittlement can be eliminated by removing the means whereby alkaline boiler waters are concentrated by using welding instead of riveting for boiler-drum construction.

Where caustic strengths and temperatures come within the danger range, the removal of stresses is the only means of combating the tendency to form cracks in the equipment.

Caustic embrittlement cracks are predominantly intergranular, caustic concentration is sufficient in most refinery operations to cause cracking of low-carbon steel. G. A. C.

134. Purcolator Oil Filter. Anon. *Gas Oil Pwr*, 1948, **43**, 307.—The element of this filter is a plastic-impregnated paper which retains particles down to 1 μ on its outer surface, in contrast to felt, cotton waste, etc., where dirt penetrates below the surface. The element is heat-resistant, water-proof, and will not warp. Diluents such as fuel or water do not affect its properties, and with detergent oils only negligible amounts of additive are removed. 500 sq. in. of filtering surface are contained in a cylinder $3\frac{1}{2}$ in diameter and 4 in thick. H. C. E.

135. Economic Aspects of Railway Diesels. O. W. Wilcox. *World Petrol.*, Oct. 1948, **19** (11), 44.—Advantages of diesel engines lie in the greater thermodynamic efficiency of the engine with consequent fuel economy and reduced costs of fuel transport. A consequence of complete "dieselization" would be the replacement of large quantities of heavy fuel oil now being burned, by smaller quantities of diesel fuel. The various economic factors are tabulated and the author concludes that steam power should be replaced by diesel power as early as possible. C. G. W.

136. Patents. Shell Development Co. B.P. 599,854, 7.4.48. Separation of non-neutral electrolytes.

Cie. Francaise de Raffinage. B.P. 599,864, 7.4.48. Halogenation of organic compounds.

Shell Development Co. B.P. 600,328, 21.4.48. Corrosion inhibition and anti-corrosion packaging.

Shell Development Co. B.P. 600,634, 28.4.48. Process for shaping metal.

Aktiebolaget Elektrolux. B.P. 602,121, 2.6.48. Liquid-fuel wick burners.

J. C. Arnold (Standard Oil Development Co.). B.P. 602,260, 2.6.48. Method of preparation of conjoint products.

T. N. Ramboll. B.P. 605,429, 5.8.48. Oil lamps.

Bataafsche Petroleum Mij. B.P. 607,755–6, 15.9.48. Manufacture of moulded synthetic resin articles.

Bataafsche Petroleum Mij. B.P. 608,078, 22.9.48. Manufacture of threads, fibres, ribbons, and films. G. R. N.

BOOK REVIEWS.

The Motor Industry of Great Britain 1948. London : Society of Motor Manufacturers and Traders Ltd. 1948. Pp. 334. 30*s*. post free.

Vital statistics in practically every aspect of the motor industry of the U.K. and, in fact, of the world are available within the covers of this book. In general the years covered are 1947 and 1946, with 1938 for comparison. Thus it is noted that while production of motor cars (287,000) and commercial vehicles (nearly 150,000) in the U.K. during 1947 was 20% higher than in 1946 and equal to the 1938 figure, the industry was still working at only between 60 and 70% of capacity.

Production of motor vehicles in other countries having an indigenous motor-vehicle producting industry is briefly reviewed and statistics given. Details of registrations in overseas countries are also tabulated.

Regulations on the use and construction of motor vehicles overseas are given in some detail and should be of value to anyone intending to take a vehicle to any of the sixty-seven places mentioned.

For a compendium of statistics on the motor industry there is no equal to this S.M.M.T. annual, and the Society is to be congratulated on its effort. G. S.

Prevention of Iron and Steel Corrosion. Processes and Published Specifications. Compiled by C. Dinsdale. London : Iliffe & Sons, Ltd., 1948. Pp. 67. 5*s*. net.

This little book is essentially an index of processes and official specifications relating to the prevention of corrosion of iron and steel.

Part 1 deals with all types of coatings for steel, including metallic coatings, oxide, chromate, and phosphate films and all types of paints and organic coverings. In addition, reference is made to processes of corrosion prevention by dehydration and electrolytic methods and by water treatment.

Part 2 covers the surface preparation of steel in readiness for the application of protective films. In Part 3 reference is made to codes of practice for the proper packaging of steel goods.

The system adopted in the book is to tabulate the different processes or coatings under their particular heading and to follow this tabulation with a list of the official specifications relevant to the processes or coatings. One valuable feature for reference purposes is that the processes are listed under their proprietary names with a brief description.

Further indications might have been given of the limitations of usefulness of some of the processes by which metallic coatings are applied, but this was presumably considered to be outside the scope of this book. In the section on cleaning metal parts some useful information is given of the efficiency of the different processes, but it is not generally considered that flame cleaning can be relied upon to remove mill-scale completely as implied in the text. Furthermore, anyone who had not specialized in the subject might gather a wrong impression of the efficiency of so-called " panel washes " for the cleaning of rusty steelwork. These solutions are only suitable for very lightly rusted metal.

A large portion of the book comprises a list of official specifications for paints and paint components, which provides a very useful reference for those who have to handle these materials.

The book is comprehensive within its scope and data for its compilation has been supplied by well-known specialists in the paint and corrosion field. H. B. F.

BOOKS RECEIVED.

Practical Inspection of Oil Refinery Equipment. J. F. Strachan. London : Anglo-Iranian Oil Co., Ltd. 1947. Pp. 141.

The aim of this book is to correlate data on inspection procedure, methods, recording, and equipment. Its chapter headings are : The plant inspection department ; Inspection procedure ; Corrosion and protection of oil equipment ; Calculations ; General safety.

Transactions of the Institution of Chemical Engineers. Vol. 23, 1945. London: The Institution. 1948. Pp. 236 + xviii.

Included in this volume are papers on "The dehydration of ethanol by azeotropic distillation: vapour–liquid equilibrium data for the system ethanol–benzene–water" (*W. S. Norman*); "The dehydration of allyl alcohol by azeotropic distillation: vapour–liquid and liquid–liquid equilibrium data for the systems allyl alcohol–water–trichloroethylene and allyl alcohol–water–carbon tetrachloride" (*C. H. G. Hands*); "Design calculations for azeotropic dehydration columns" (*W. S. Norman*); "Automatic control in the oil industry" (*D. J. Pull*); and "Liquid flow conditions in packed columns" (*S. S. Grimley*).

Proceedings of the Institution of Mechanical Engineers, Brief Subject and Author Index 1847–1947. London: The Institution. 1948. Pp. 215.

Journal of the Iron and Steel Institute. Vol. 154, 1946. London: The Institute. 1948. Pp. 476 + 145 + 48 + x.

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Oilfield Exploration and Exploitation.

Geology.

137. Origin of Petroleum. A. Treibs. *Erdöl u. Kohle*, 1948, **1**, 133–143, 185–199.—Geological investigations have shown that decaying matter, composed mainly of lower plants and animals, deposited in anaerobic conditions on the bottom of confined seas must be considered as the base material of petroleum. Recent discoveries regarding the constitution of the low mol.-wt. portions of crude oil enable exact comparisons to be made with the structure of the principal components of such organisms, carbohydrates, albumen, and fat. Points that still require elucidation are the synthesis and degradation of the carbohydrate skeleton and the reduction of this primary material. The quantities of fatty oil in the deposited organisms are inadequate to explain oil formation; moreover, deposits in which these components alone of the organisms are found, as required by the Engler theory, are unknown. The theory is thus now put forward of biological processes whereby carbohydrates and albumen are reduced by the action of anaerobic micro-organisms into substances that can be converted into hydrocarbons. Possible reactions of this type are suggested, including the necessary heats of reaction. The only probable substances for conversion into hydrocarbons are *n* fatty acids, since these are the only class of bodies which are highly reduced and which are present in the organisms in appreciable quantities. A number of cat reactions of carboxylic acids and hydrocarbons are known whereby through fission, condensation, isomerization, cyclization, and dehydrogenation hydrocarbons, such as are present in petroleum, are formed. Examples of such reactions are given. It may further be assumed that by the action of weak cat at moderate temp similar

reactions can occur to those that take place in the laboratory under the influence of highly active cat. A further effect is the migration of oil through the reservoir structure with consequent separation of certain types of material due to adsorption phenomena. V. B.

138. Cosmic Origin of Oil and Gas. C. E. van Orstrand. *World Oil*, Nov. 1948, **128** (7), 150.—It is considered that the various depressions on the moon's surface result from gas escape. If the earth and moon were originally one mass, the former also must once have contained much gas. Volcanism also seems to be a remnant of a primitive thermal and gas-evolving process inherited from the parental sun. Many earthquakes originate at depths of 50–300 miles, and it is suggested that deep down hydrogen, carbon, nitrogen, and oxygen are the fundamental elements controlling outflow of energy. Certain studies suggest that the earth's interior is much more gaseous and mobile than formerly believed.

99·93% of the sun's atmosphere is hydrogen and helium. Oxygen, magnesium, silicon, nitrogen, sulphur, and carbon follow in order of abundance. The atmospheres of Jupiter, Saturn, Uranus, and Neptune contain methane and ammonia; these planets probably have hydrocarbons in their solid masses. Measurable amounts of methane have been found in meteorites in addition to other gases.

Astrophysics generally indicates the presence in stars, sun, planets, comets, meteorites, and interstellar space of methane and methyne, (CH).

Geologists practically agree that oil and gas originate in marine sediments, and these thick sediments overlie mobile segments of the earth's crust. Oil is more abundant in recent than in ancient sediments. When gas in the interior of the earth does not cause disruption and volcanoes, it may penetrate the bed rock and reach the upper levels of the thick sediments. This latter condition may be most easily attained in mobile belts of the crust. Faults and fractures increase with time, and so there may be enhanced chances of gas accumulation in the younger rocks.

Nitrogen and helium in natural gas may be associated in origin; and the latter is deemed to be primordial by Rogers. Migration from depth is indicated in some cases where the amount exceeds that which can be attributed to radioactivity. Cosmic hydrogen, nitrogen, and methane could follow similar paths. The evidence of meteorites seems to support this. The atmosphere and ocean are also believed to have originated in the earth's primitive magma.

It is therefore concluded that oil and gas fields are a result of a uni-directional process beginning with methyne either in the sun or in interstellar space. G. D. H.

139. Differential Thermal Analysis. A. J. Kauffman. *World Oil*, July 1948, **128** (3), 118.—Examination of clays by X-ray methods may reveal largely the dominant mineral and not the pattern of others. The small grain size may render microscopic work unsatisfactory, because mean optical characteristics are shown by the mixtures. In the differential thermal technique the thermal effects associated with loss of water, oxidation, or change of structure on heating are recorded. A clay sample and a thermally inert substance (alundum or calcined alumina) are heated in a suitable holder and any temperature difference between the two is noted by means of a difference thermocouple. The intensities of the thermal reactions and the temperatures at which they occur differ for each clay mineral, and so the records afford a method of identifying the minerals.

The holder is usually a nickel block with two $\frac{1}{4}$-in dia holes to hold the sample and reference material. This block is placed in an electric furnace. The heating rate is usually 10–12° C per minute; maximum average deviation from the furnace temperatures due to endothermic reaction is 8–10° C. The differential and furnace temperatures are recorded automatically.

Clay minerals fall into three groups: kaolin, montmorillonite, and illite. The particles are crystalline and range 2–5μ in size. The kaolin group is most stable. The montmorillonite group, due to its structure, is able to hold water loosely. Low-valency ions may replace silica and alumina, leaving unbalanced charges to be satisfied by sodium, potassium, etc. The illite or "hydromica" group sometimes is capable of base exchange like the montmorillonites, but is also stable like the kaolin group. Grim considers it the most widely distributed clay mineral in present-day marine argillaceous deposits.

Packing, grain size, and rate of heating affect the thermal curve.

At about 450° C kaolinite begins to lose water, and this endothermic reaction reaches its peak at about 580° C. The lattice also is destroyed, and the material is then said to be a mixture of amorphous alumina and silica. A sharp exothermic peak occurs at about 980° C and is associated with crystallization of the alumina. These two peaks are detectable in mixtures with only 10% of kaolinite. Other kaolin minerals have comparable peaks.

Montmorillonite shows an endothermic peak at 100–250° C due to loss of swelling water. Constitutional water is lost at 600–700° C. The lattice is destroyed at 900° C, and a small exothermic peak which follows may be associated with spine formation. The peaks for illite are generally of the same type. G. D. H.

140. Relative Role of Some Geological Tools in Oil Exploration. H. H. Suter. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 2127–2139.—The author emphasizes that geophysical methods of oil exploration are really only special methods of geological mapping. To translate geophysical results into geological data the translator must have an adequate geological training and experience. Conventional geological tools, such as hammer and compass, are still modern. The evolution of a geological section by the integration of data from various sources is demonstrated by means of a generalized case.

A plea is made for integrated symposia on regional geophysical geology and for more publication of data on geophysical failures. E. N. T.

141. World Petroleum Reserves. G. C. Gester. *World Oil*, Nov. 1948, **128** (7), 252.—At the end of 1947 the U.S.A. was credited with 24,000 million brl of proved oil reserves. New discoveries are often enhanced by extensions and revisions, and from 1937 to 1947 4900 million brl were attributed to new discoveries in the U.S.A. Previous experience suggests that these may ultimately provide an additional 14,000 million brl.

The data available for estimating reserves outside the U.S.A. are not so full as in that country, and therefore estimates vary for certain countries. For the world the figures range from 61,914 million to 73,432 million brl.

Areas with oil possibilities are shown on a world map.

In 1947 the U.S. produced 2,011,277,000 brl of crude oil and natural-gas liquids; the world figure is placed at 3,174,980,000 brl. The U.S. cumulative is 35,227,486,000 brl, or 64% of the world total.

The reserves of the Persian Gulf area are conservatively placed at 25,599 million brl. Little is known about Russian reserves, but they are tentatively put at 6000 million brl.

Tertiary basins have produced 58% of the world's oil output and hold 58% of the reserves. 88% of the known reserves are Mesozoic or younger, 13% being Jura-Triassic.

88·3% of the 35,716 million brl reserves attributed to the western hemisphere are credited to U.S. ownership, and 8·6% to British–Dutch control. Excluding Russia, about 41·6% of the Eastern hemisphere reserves are classed as U.S. owned.

Of total world reserves 62% are U.S. controlled and about 20% British controlled.

Tables and diagrams give data on reserve estimates, annual production, growth of reserves, reserve distribution by geological formations, and ownership of reserves.

G. D. H.

142. Wildcatting at Highest Peak. Anon. *World Oil*, Aug. 1948, **128** (4), 52. 2706 strict wildcats were completed in the U.S.A. in the first half of 1948; the corresponding figure for 1947 was 2084. The 2706 wildcats constitute 15·2% of the U.S. completions in the first half of 1948. 11·5% of these completions were productive, and 321 oil, condensate, and gas fields were discovered. A table summarizes by States the results of wildcat wells in the first half of 1948 and in the period 1937–47. G. D. H.

143. Oil Discovery at Cuyama Valley, California. R. Sneddon. *Petrol. Engr*, July 1948, **19** (11), 37.—Russell A.28–5 flowed 500 b.d. of 38·3° oil on a ¾-in choke from 2970–3360 ft. Anderson–Colgrove 37–30, 2½ miles to the northwest, flowed 33° oil at 4000 b.d. from 3019 ft.

The Cuyama sedimentary basin is 50 miles long and 15 miles wide, lying midway between the San Joaquin Valley and the coastal region.

Up to 1941, eleven unsuccessful wells had been drilled in the Cuyama Valley area. Seeps were known in the Temblor and Monterey.

Russell No. 1, producing 20° oil from 2800 ft, appears to be at a different horizon from the other two wells. G. D. H.

144. Cuyama Valley Discovery May Improve California Reserves. G. M. Wilson *World Oil*, Aug. 1948, **128** (4), 87.—Russell A–28–5 and Anderson–Colgrove 37–30 in the Cuyama Valley constitute one of the most significant discoveries in California in recent years. Anderson–Colgrove 26–30, some 1000 ft northwest of the discovery well has flowed 33° oil at the rate of 6000 brl/hr in a drillstem test at 2780 ft. The oils differ in gravity in the two areas. The discoveries open considerable areas for further exploration. Based on existing wells, the proved areas are 500–1000 acres.

There appears to be a fold against a major fault which is locally overthrust and there are branching secondary faults. Oil is trapped against the major and the secondary faults. Production is believed to be from sands in the Lower Miocene. G. D. H.

145. Offshore Drilling and Development. M. H. Parks and J. C. Posgate. *Oil Gas J.*, 11.11.48, **47** (28).—The continental shelf out to 600 ft of water covers 129,000 sq. miles off the U.S.A. in the Gulf of Mexico, and is 70–175 miles wide. In an area of 60,000 sq. miles just inland there are 1300 known oil and gas fields. Wells have been drilled in water up to 60 ft deep, and as far as 30 miles offshore. The Kerr–McGee discovery, in the Ship Shoal area (Terrebonne Parish) gives super-cap production at 1734–1750 ft and deeper production at 2808 ft. The Humble discovery in the Grand Isle area (Jefferson Parish) produces from 8640–8665 ft.

The troubles encountered in offshore drilling are described, together with the drilling platforms, equipment, technique, transportation, development, and producing operations.

A list of the offshore wells is given, together with their sites and status. G. D. H.

146. Continental Shelf Activity Intensified. L. J. Logan and C. Smith. *World Oil*, July 1948, **128** (3), 37.—At the beginning of June 1948 operations were in progress on thirteen locations in open Gulf waters. Ten of these were off the Louisiana coast. The seaward boundaries of Texas and Louisiana are 27 miles (marine) from shore. Seismic and gravity work has been carried out. Refraction and diving-bell gravity-meter techniques are favoured for reconnaissance.

It is estimated that at least thirty-six salt-dome prospects have been mapped and leased in the coastal waters of Louisiana. They seem to be similar to those on land. Drilling has been undertaken in water up to 50 ft deep, and it is considered that present methods and equipment could be used in water up to 150 ft deep. The offshore area with water less than 150 ft deep covers 30,500 sq. miles off Texas and Louisiana, and this area might yield 5800 million brl of oil.

The Creole field off Cameron Parish, Louisiana, in 9 ft of water and 1 mile offshore, has produced 2,800,000 brl from seven producers drilled from a single platform.

The wells drilling off the Texas and Louisiana coasts are listed with the location, company, water depth, and distance from land. G. D. H.

147. Marine Field. L. S. McCaslin. *Oil Gas J.*, 21.10.48, **47** (25), 101.—Three good producers have been completed 10 miles offshore from Point au Fer, Terrebonne Parish, Louisiana. The discovery well gave 900 b.d. from 1700 ft. Each of the three wells appears to be in a different sand; the sands are loose and highly permeable. The wells are 1500–2900 ft deep and probably cost $150,000 each. Cost of the first 45,000 brl of oil (production, transportation, and storage) was 85 cents/brl, but with 3500–4000 b.d. it may be 45–50 cents/brl. The oil is shipped by barge.

In Block 28, 8 miles to the east, a well has reached 14,234 ft. The electric log indicated shows at 6600 ft and 8800 ft; a gas-distillate sand was drilled through at 13,973–14,045 ft, and an unknown pay at 14,060–14,071 ft. The well has already cost $960,000. G. D. H.

148. Deep Drilling and Deeper Oil Possibilities in Illinois. L. E. Workman and A. H. Bell. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 2041–62.—During 1944–47 sixteen oil

test wells were drilled in Illinois to the St Peter sandstone, of which thirteen penetrated to formations below the St Peter, two reaching basement.

The authors present isopach maps of various formations between the St Peter sandstone and the basement rocks, together with cross-sections.

Maps are also presented to show the structure of the Illinois basin on the top of the St Peter sandstone and the general configuration of the basement surface. Isocons on the St Peter map show the total mineral content of water in the St Peter sandstone.

E. N. T.

149. Classification of Pennsylvanian Rocks in Iowa, Kansas, Missouri, Nebraska and Northern Oklahoma. R. C. Moore. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 2011–2040.—The State Geological Surveys of Iowa, Kansas, Missouri, Nebraska, and Oklahoma have agreed on the principal features of Pennsylvanian stratigraphical classification affecting territory northeastward from northern Oklahoma.

The stratigraphic succession of Pennsylvanian rocks is well suited to serve as a standard of reference in studying Pennsylvanian sections and geological history in other areas. The classification of these rocks in the several States, developed mainly during the last fifty years, has had many features in common, but has also exhibited noteworthy discrepancies. The establishment of a classification that ignores State boundaries in the northern Mid-Continent area is of importance to all interested in the area.

The State surveys agree in recognizing Pennsylvanian rocks as a geological system and in defining major time-rock subdivisions within the system, which in upward order are called Desmoinesian, Missourian, and Virgilian. Groups are defined in upward order: Cherokee, Marmaton, Pleasanton, Kansas City, Lansing, Pedee, Douglas, Shawnee, Wabaunsee. In northern Oklahoma and parts of southern Kansas, rocks of Missourian age are recognized as belonging to the Skiatook and Ochelata groups. The Kansas City group extends from the base of the Hertha limestone to the base of the Plattsburg limestone; it includes the Bronson, Linn, and Zarah subgroups. The Wabaunsee group has Sacfox, Nemaha, and Richardson subgroups.

E. N. T.

150. Hitesville Consolidated Field, Union County, Kentucky. H. H. Bybee. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 2063–2082.—The structure of the Hitesville Consolidated field is a broad, irregular anticline trending north and south in Union County, Kentucky, at the southern end of the Illinois basin. The field was discovered in 1943. The present productive area is approximately 3500 acres of Cypress and Aux Vases sands. The Ste Genevieve of the Lower Mississippian produces from seven separate porous McClosky zones. 61% of the wells produce from McClosky (Upper Mississippian) sands, and 20% from porous zones in the Cypress (Upper Mississippian) formation. The most notable feature of this field is the multiple-zone McClosky production.

E. N. T.

151. Central Montana Attracts New Interest. Anon. *Oil Gas J.*, 21.10.48, **47** (25), 163.—Amerada Petroleum Corp 1 Hougen, SE–SE 23–10n–29e, Musselshell County, has found the Kibbey sand (Mississippian) productive in a drillstem test at 4020–4028 ft. 34° oil flowed. Texas Co. 1 Zoerb, SE–NW–SE 18–10n–27e, on the Big Wall structure recovered 30° oil in drillstem tests of the Amsden at 2811–2823 ft and 2823–2832 ft. Both wells are on local features of the Big Snowy anticlinorium. G. D. H.

152. New Strikes Add Vast Area to Permian Basin. H. H. King. *World Oil*, Aug. 1948, **128** (4), 56.—A 12,215-ft Devonian discovery on the Cross Roads geophysical prospect in northeastern Lea County, New Mexico, has opened a large area for future exploration. The structure appears to be substantial. It is south of a barrier of buried granite mountains forming the northern boundary of the South Permian Basin. This barrier extends east to the Electra Arch of North Texas. On its apex this barrier has given some production in the Permian and Pennsylvanian. The Permian beds south of the barrier do not reflect the steep and sharply faulted pre-Permian structures. The Devonian and Simpson are not present on the barrier or immediately to the north or south in Texas.

The Cross Roads well has a potential of 3744 b.d. of 42·6-gravity oil with a gas–oil ratio of 260 on a ¾-in choke.

Notes and a table give data on deep tests drilled in the general area of the Cross Roads discovery. G. D. H.

153. Cotton County Poor Boy's Paradise. J. D. Pate. *World Oil*, Oct. 1948, **128** (6), 122.—Oil was first found in Cotton County, Oklahoma, in 1917, at Walters, but important production was not developed until the Essaquanahdale pool was opened in 1946. Several hundred dry holes were drilled in the interval. A recent boom began with a 27-brl well in the Cache Creek sand at 1490 ft, and discoveries were made at Cache Creek, Soldier Creek, Cookietown, and Randlett. Most wells require 3–5 days to drill and cost about $6000. A 440-ft spacing has been used.

Surface mapping has indicated a few flat structures. Subsurface features of importance are the Wichita, Red River, and Arbuckle uplifts, together with some Permian folding. The Wichita uplift seems to have two ridges of different ages; the Red River uplift appears to be of similar age to the Wichita uplift. Slow rise of the Arbuckle uplift seems to be responsible for the sand lenses which produce in Cotton County. The Permian folding is gentle.

The new Cotton County production lies along a northwest–southeast buried ridge, and this may have been a strand-line or an offshoot from the Red River arch. The sands were probably deposited by an advancing sea, and oil may have originated in the enclosing Lower Cisco and Upper Canyon shales.

Tests of the Canyon limestone and Arbuckle dolomite have given only salt water. G. D. H.

154. Origin of Red-Banded Early Cenozoic Deposits in Rocky Mountain Region. F. B. Van Houten. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 2083–2126.—Red-banded early Cenozoic formations in the Rocky Mountain region are generally fluviatile, piedmont, and valley-flat deposits.

Illite is the predominant clay-mineral group in most samples tested; kaolinite is occasionally the dominant clay-mineral group, but only a small amount of montmorillonite is commonly present.

Chemical analyses show a higher Fe_2O_3 content in the red beds, the red pigment being probably hematite, which is interpreted as primary, derived either from older red formations exposed at the basins' margins or from red soil developed on the surrounding uplands.

The paper reviews the lithologic characteristics and stratigraphic relationships of the various formations, together with the paleobotanical evidence of a warm, humid early Cenozoic climate which suggests that red upland soil was transported into the basins. E. N. T.

155. Third Pay from Benedum Field in West Texas. Anon. *Oil Gas J.*, 14.10.48, **47** (24), 143.—At Benedum, West Texas, a well 2¾ miles north of the Ellenburger discovery, has produced 59° oil at the rate of 18–20 brl/hr from the Fusselman pay of the Silurian at 11,242–11,310 ft. The gas–oil ratio was 6000. Another well is giving 287 b.d. from the Pennsylvanian, and lies ½ mile west and 1 mile north of the Fusselman producer. Oil shows have been found in the Devonian. G. D. H.

156. Utah Gets a Third Oil Strike Down in South-East Corner. Anon. *Oil Gas J.*, 4.11.48, **47** (27), 133.—A well in SE–SE–NW 22–43s–22e, San Juan County, Utah, is bailing 100 b.d. of 42·7° oil from the Coconino sandstone at 1514 ft. Earlier wells had had shows in this formation. One in SW–SW–NW 22–43s–22e had gas shows at twelve points and oil shows at six. Eventually it gave 30 b.d. from the Shinarump conglomerate before going to water. A gas flow of 15,000,000 cu.ft/day was estimated.

Devil's Basin gave 20,000 brl of oil, and Cat Creek was an important producer. To the end of 1947 the Gage field had given 337,000 brl from the Amsden. Some oil has been found in the Lower Cretaceous at Rattlesnake Butte, and Ragged Point produces from the Kibbey sand.

The Cat Creek oil is a freak, and some of the formations have very large artesian flows. About 16,000,000 brl have been produced. G. D. H.

157. Cambrian Production at Lost Soldier is Significant Wyoming Discovery. G. M. Wilson. *World Oil*, Nov. 1948, **128** (7), 76.—Drayton-Consolidated 2, an old Tensleep producer, was deepened from 4772 ft to 6288 ft, and flowed 700 b.d. of 33·9-gravity oil from a Cambrian sand. Production is from 5965–6145 ft. Below 6145 ft were pre-Cambrian and granitic rocks. The Cambrian sand is a coarse conglomeratic quartzite with 10–12% porosity. The oil gravity is practically the same in the Tensleep, Amsden, Madison, and Cambrian at Lost Soldier. A common oil source is therefore suggested. The structure is highly faulted, raising the possibility of intercommunication. Moreover, no oil has ever been produced from a formation at a point lower than the oil–water level in the Tensleep.

Elsewhere wildcats in Wyoming have had oil shows in the Cambrian. These include a well in the Oregon Basin field. (Flathead sand at 6341–6346 ft).

In Southwest Wyoming and Northeast Utah the Cambrian and pre-Cambrian formations are thick and include sandstones and limestones.

Cambrian has been met in a deep test at Wertz. There were oil showings between 7600 ft and 7630 ft. G. D. H.

158. Cambrian System Adds Deeper Rocky Mountain Objective. J. A. Kornfeld. *World Petrol.*, Nov. 1948, **19** (12), 80.—Cambrian oil production has been obtained in the Little Lost Soldier field of Wyoming. 34·5° oil is obtained from a depth of 5475 ft. Pre-Cambrian was met at 6150 ft. In 1945 a well at South Oregon Basin logged live-oil saturation in Cambrian sandstone. In the Branson pool of New Mexico high-gravity oil is produced from Upper Cambrian below the Ellenburger.

Little Lost Soldier also has production in Upper Cretaceous, Comanche, Tensleep, the Amsden, and Madison. It is an elliptical, faulted dome with 3500 ft closure.

Wertz is a symmetrical, slightly faulted dome with 1200 ft closure. Gas has been found in the Dakota, Lakota, and Sundance, and oil in the Tensleep and Madison. Bunker Hill is a faulted, elongated dome. The Steele yields gas. The Mahoney dome is on the same line as Wertz. Gas occurs in the Dakota and Sundance, and oil has been found in the Tensleep. The Hatfield gas field produces from the Muddy. In 1947 oil was found in the Tensleep, and later gas was proved in the Dakota.

Maps and cross-sections show the structure and stratigraphy of parts of Wyoming; tables correlate the formations of the Rocky Mountain area, and give drilling depth and producing depth records in addition to a summary of the drillstem tests on the Cambrian at Little Lost Soldier. G. D. H.

159. Navy Plans to Drill Three More Test Wells in Alaska Next Year. Anon. *Oil Gas J.*, 28.10.48, **47** (26), 63.—A test south of Point Barrow has reached 3000 ft, and is intended to test a 110-ft Upper Cretaceous sand and shale section.

It is expected that a 15,000-ft rig will be used to test the Oumalik No. 1 anticline. A 2500-ft test is planned for the Maybe Creek dome, and a further well in the vicinity of Umiat. A 2000-ft well is recommended in the area of the Simpson seeps.

Four seismic parties will operate in 1949, and the airborne gravity-meter work will be resumed. G. D. H.

160. Fifty Years of Petroleum Geology in Canada. G. S. Hume. *Canad. Min. metall. Bull.*, 1948, **42**, 207–211.—Oil production in North America was 61 million brl in 1897 and 1,917 million brl in 1940; the corresponding gas outputs were 400,000 million cu. ft. and 4,500,000,000 million cu. ft., respectively. The anticlinal theory, first propounded in 1844 by Logan, has been important in this development. Rogers and Hunt made comparable statements, and in 1883 I. C. White put the idea to use in prospecting for anticlinal accumulations of oil and gas. Later terrace structures were considered, though these alone are not now believed to constitute traps. Early this century faults were shown to cause accumulations at times.

Hydraulic currents and later capillary forces were put forward to explain oil migration. Long- and short-distance migration were debated, and some evidences of local oil origin were described.

The Athabaska tar sands are said to have oil which has originated in the Devonian or in the Lower Cretaceous.

The evidence of a down-faulted block at Turner Valley indicates that the oil accumu-

lated before the faulting, and suggests that primary folding is of importance in the determination of the sites of oil pools in the foothills.

Faults may permit escape of hydrocarbons for a time and become sealed later.

G. D. H.

161. Prospecting for Oil in the Northwest Territories (Canada). J. M. Parker. *World Oil*, Sept. 1948, **128** (5), 210.—The Mackenzie basin consists of many small topographic and structural basins separated by structural mountain uplifts. On the east is the Canadian shield. The basin is 700 miles long and 100–200 miles wide.

The first geological exploration was in 1887–88, and the first oil exploration was in 1911 by Bosworth, who staked claims in seepage areas which include the Norman Wells field. Detailed investigation of the general Norman Wells area was done by Link in 1919–21, and the discovery well was drilled in 1920.

Oil was encountered from the surface downwards, and the well was completed in Devonian shale with a total depth of 783 ft. Three wells were drilled between 1920 and 1942 within a mile of the discovery well, and fuel was supplied for local needs. Three dry wildcats were drilled within a radius of 10 miles of the discovery.

The Canol project showed the field to be developed in porous Upper Devonian reef limestone on a monocline.

The proven area is 4300 acres, and the reserves are estimated at 35 million brl. Wells are 1500–2000 ft deep.

Surface parties have worked out the general structure and stratigraphy of the Mackenzie Basin and a seismic party has operated near the Norman Wells field. Four dry wildcats have been drilled on surface structures, but all were near the river. Gravity work has been carried out in selected areas.

In the central part of the basin the average thickness of the sedimentary section is probably 12,000 ft; in the east the section thins to zero. Cambrian, Ordovician, Silurian, Devonian, and Cretaceous beds are present in most of the basin, while Mississippian, Pennsylvanian, Permian, and possibly Triassic are present in the northwest and southwest. There are two small Tertiary basins. Possible source rocks exist in Cambrian, Ordovician, Middle and Upper Devonian, Lower and Upper Cretaceous, and Eocene. Fair to good reservoir rocks occur in the Silurian, Devonian, Carboniferous, Cretaceous, and Eocene.

There is no measurable angular unconformity between the Devonian and Lower Cretaceous, and therefore Cretaceous structure generally reflects older structure. It is possible that there are buried reefs like that at Norman Wells, and so palæogeographic maps have been compiled from the meagre data available. There are other problems with regard to the distribution of possible reservoir rocks.

It is believed that the area is suitable for surveying by the aerial magnetometer. Detailed gravity work might assist in locating reefs when reef trends have been indicated. In seismic work correction for the permafrost zone is needed.

A 150-million-brl reserve must be discovered before a pipeline to the Pacific is justified.

G. D. H.

162. Imperial's Redwater Discovery. C. O. Nickle. *World Oil*, Nov. 1948, **128** (7), 247.—Redwater 1 is about 50 miles northwest of Leduc. Production is from the equivalent of the prolific Leduc D-3 Devonian horizon. On test the well yielded 1728 b.d. on 2-in open tubing, with a gas–oil ratio of 200. The depth was 3264 ft, 140 ft of porous oil-bearing limestone having been penetrated. Acidization raised the producing rate. Further wells have been spudded 5 miles due north and 4½ miles southeast. Shallower Devonian and Cretaceous beds bear much gas. No gas–oil contact has been defined, but the oil–water contact was 140 ft below the top of the formation.

Crown reservations have been taken over several million acres north, east, and south of the strike.

G. D. H.

163. Mexico Has First Big Oil Discovery in Ten Years. Anon. *World Oil*, Aug. 1948, **128** (4), 254.—Reynosa Well No. 1 just south of the Rio Grande in the State of Tamaulipas is the first oil producer between that river and Tampico. 42 ft of high-pressure gas sands were met at 6318 ft, and oil-producing sand was first met at 4500 ft. It is reported that the well may be capable of 10,000 b.d.

G. D. H.

164. Discovery Spurs Mexico Exploration. Anon. *World Oil*, Oct. 1948, **128** (6), 230.—Pemex has completed Reynosa No. 2 with 1000 b.d. of 62° oil at 4628–4637 ft. It is near the discovery well.

Negotiations are in progress between Pemex and several American companies, but it is denied that new wells are planned in the old fields of Molocan, Punta Gorda, Vernet Huimanguillo, and Encrucijada.

Reynosa appears to be a gas-distillate field. The discovery well produced from 7070–7078 ft, and gave 1000 b.d. on a ¼-in choke. This production is believed to be from the Vicksburg. The second well produces from non-marine Oligocene above the Vicksburg.

Oil showings are reported in Brasil 1, west of Matamoros, and in Valadaces 1, in the extreme northwest of Tamaulipas.

In May, Mexico's production averaged 161,479 b.d., the highest for about twenty years; Poza Rica gave 94,627 b.d. G. D. H.

165. San Sebastian Discovery Brightens Oil Outlook in Chile. Anon. *World Oil*, Sept. 1948, **128** (5), 222.—San Sebastian lies about 55 miles southeast of Spring Hill (Cerro Manantiales). The discovery well has 100 ft of sand correlated with that which produced at Spring Hill. The structure is believed to be anticlinal and rather larger than at Spring Hill. 40° oil is present, but the producing potentialities remain to be determined.

At Spring Hill the proved oil-bearing area is 700 acres, and the oil section averages 65 ft. An effective water drive is thought to be present. 4 miles to the north a dry well has been drilled. G. D. H.

166. Outlook Bright for Greater Oficina. G. O. Ives. *World Oil*, July 1948, **128** (3) 209.—Production in the Oficina, Venezuela, area is from the Oficina formation which has numerous lenticular sands. The largest single field, Oficina, covers 13,500 acres, and consists of about a dozen separate accumulations against faults. There are major and minor faults.

In the Oficina area, accumulation is usually on the northern side, irrespective of the direction of throw, but some fields produce from both sides. The beds dip generally north or northwest. The discovery well was based on torsion balance and refraction work, and was completed in 1937 at 6184 ft. Eleven sands were found between 4000 and 5995 ft. The output from 5292–5995 ft was 1325 b.d. on a ¼-in choke.

The first oil was exported late in 1939. Now the area has twenty-nine separate fields, many never fully developed. In some areas most of the wells are dual- or triple-zone producers. The area has given 232,682,694 brl, and in 1947 it gave 55,981,326 brl.

Guara has given 81·5 million brl, and has forty-seven distinct producing sands, some of which are sheet sands. The area is 3350 acres with 700,000 acre-ft of producing sand. Core drilling to 2500–3500 ft has been very satisfactory even though several thousand feet from the Oficina formation. The deeper beds give heavier oil.

Early in 1948 the pipeline capacity was 180,000 b.d.

Drilling and completion practices are briefly described. A small-scale water-flooding project is in operation, and pressure maintenance and repressuring are to be undertaken. G. D. H.

167. New Discoveries Extend Two Fields in Venezuela. Anon. *Oil Gas J.*, 28.10.48, **47** (26), 61.—A new Tucupido well has flowed 39·6° oil at 400 b.d., making the ninth producer and representing a two-location step-out to the east. The field's output is 7200 b.d.

A third producer has been completed at Pelayo. G. D. H.

168. International News. Anon. *World Oil*, Aug. 1948, **128** (4), 253.—San Martin 5 in the Llanos area of Colombia was abandoned at 7996 ft, having given no commercial oil shows. The second well had heavy oil shows.

The El Roble field of Venezuela has been extended ¾ mile west.

The Ain Dar field of Saudi Arabia is 27 miles west of Abqaiq, and may become a major field. A well now at 6900 ft has 250 ft of oil sand and a large producing rate. G. D. H.

169. International News. Anon. *World Oil*, July 1948, **128** (3), 230.—Between Ferrara and Ravenna, Italy, a new gas field is estimated to have reserves of several thousand million cu. ft., and the output is 105,000 cu. ft./day from 1500–1800 ft. A small gas discovery has been made in Modena Province.

The Mexican output in 1947 was 56,130,255 brl, 14·4% more than in 1946.

G. D. H.

170. Morocco Gets Small Well. Anon. *Oil Gas J.*, 4.11.48, **47** (27), 45.—Four wells in the Soukeb–Arba area together give 210 b.d., and a fifth completion will give 50 b.d. G. D. H.

171. Oil Possibilities in Lesser Known African Territories. Anon. *World Oil*, Aug. 1948, **128** (4), 244.—Prospecting is being continued in the western part of Madagascar. Before the war five wells gave small amounts of very heavy crude. The possibility of obtaining oil by distilling bituminous sandstone has been rejected because of high costs. The sediments on the west side of the island range from Permian to Tertiary in age, and lie in a number of basins.

In Portuguese East Africa there is a coastal strip of Cretaceous to Upper Tertiary sediments. A deep test was drilled on the Injaminga anticline, and a few shallow wells found traces of pitch and ozokerite in the lake Nhangela region.

A number of wells have been drilled in South Africa near seepages, which probably arise from the igneous distillation of coal seams. Some shows in Basutoland may be of a similar type.

At Kibero and Kibuku in the Albertine depression, seeps of asphalt and paraffin-base crudes have been noted. A test well on the Waki dome showed small amounts of oil. It may not have been on the crest.

In Angola there are bituminous sandstones and limestones of Cretaceous age. Wells drilled many years ago had small oil shows. G. D. H.

172. Egypt's Production in 1948 May Exceed 1947 Output. Anon. *World Oil*, Oct. 1948, **128** (6), 242.—In 1947 Egypt produced 8,913,000 brl of oil. A second well has been completed in the Asl area with 600 b.d. initially. It is 9 miles south of Sudr and produces from similar formations.

Many Ras Gharib wells produce much water. Successful new wells have been completed in the Hurghada field. G. D. H.

173. Production up in Persian Gulf Area. Anon. *World Oil*, Oct. 1948, **128** (6), 234.—At the beginning of 1948 the Saudi Arabian fields averaged 305,000 b.d., but in July the figure was 420,000 b.d.

Ain Dar is 27 miles west of Abqaiq. The well topped 250 ft of pay at 6585 ft in the lower Arab limestone. It is on a north–south line of folding which has been traced for over 125 miles. At the beginning of 1948 Abqaiq was producing 200,000 b.d. from seventeen wells, with ten other wells not connected to the gathering system. G. D. H.

174. Postwar Progress in China's Northwestern Oil Field. K. L. Lu. *World Oil*, July 1948, **128** (3), 205.—The Laochunmiao field of Kansu Province produces about 2000 b.d. and has nineteen flowing wells out of thirty-four drilled. The field was discovered in 1939, the discovery well being a small pumper in the " K " sand at about 420 ft. In 1941 the prolific " L " sands were met at 1350 ft.

To the end of 1947 the " L " sand had given nearly 3 million brl.

The Kunghsingsham anticline has many seeps and is believed to be the world's highest field. Oil apparently was formed in the Upper Palæozoic and Lower Mesozoic. Some consider the Permian, Triassic, Jurassic, and Cretaceous to be continental. The Lower Carboniferous rests on metamorphics. Oil from the Carboniferous is believed to have migrated to the Tertiary via thrust faults. The main beds penetrated are the Red Beds (Tertiary). The south flank dips at 12–18° and the north flank at 60–68°. There are axial faults.

The " K " sand is about 12 ft thick, and the three sands of the " L " series have a productive thickness of about 85 ft.

Weighting of the drilling muds is needed to combat high pressures.

A reserve of 75 million brl has been estimated, but more recently a figure of 180 million brl has been given. At the end of 1947 gas–oil ratios averaged 750 cu. ft/brl. The oil is 32·2° gravity and gives 21·5 gal of gasoline/brl. It has 15% wax which causes clogging.

Tables give production data. G. D. H.

175. Japan's New Exploration Programme. Anon. *World Oil*, Aug. 1948, **128** (4), 229.—At the end of the war most of Japan's producing fields were drilled up, and in the depletion stage. Early in 1947 the fifty-eight fields were estimated to have reserves of 14,137,623 brl. A committee has been formed to promote the search for oil. In the 1947–48 fiscal year thirty-five wells, including ten producers, were completed. The ten productive exploratory wells had a total initial potential of 250 b.d. Two on the Betsuyama block of the Nishiyama field found oil on the steep faulted flanks of the cross-faulted anticline which had previously yielded wet gas. This narrow structure may give five wells. There may be six locations on the west flank of the Yabase anticline. Two small oilfields, Narahashi and Nishi-Ishinazaka, have been found near the Ishinazaka field. Both are fault traps, and together they may ultimately give 700 b.d.

Seismic work has revealed three structures in producing basins. Thirty oil seepages and oil indications have been found in an area of Upper Cretaceous rocks in central Hokkaido near large structures which have no older exposures than Paleogene. In the Toyama basin a greater thickness of possible source rocks than previously suspected together with two possible structures have been found.

Tables summarize the salient points concerning the ten successful wildcats completed in the 1947–48 fiscal year, and give the proved reserves of Japan's fields in March 1947, together with the state of depletion. A map shows the productive basins, and the other sedimentary basins. G. D. H.

Geophysics and Geochemical Prospecting.

176. Aerial Surveying-Applications in Petroleum Exploration and Exploitation. P. G. Mott. *Petroleum*, Sept. 1948, **11**, 197.—Contributions which air survey can make to the development of oil production are discussed in detail.

Photogeology and the production of topographical maps by photogrammetric methods form the subject of this paper.

Photographs and maps are included. F. W. H. M.

177. Airborne Equipment Speeds Seismograph Surveys. E. Sterrett. *World Oil*, Nov. 1948, **128** (7), 95.—Seismic equipment has now been designed in order that it can be transported by air, and a helicopter has been successfully employed in marshy areas. Floats are fitted instead of conventional landing gear, and when inflated at a low pressure landing on rough surfaces is possible. Suitable helicopters have a pay-load of 400 lb, and when more powerful engines are fitted this may be raised to 600 lb. Transport is possible in all seismograph-working weather. Now seismographs are mounted in a special aluminium boat, and this breaks into two sections which can be transported separately supported between the floats. Pipe may be carried across the float braces. Sectional drilling rigs have been made. Shot wires, and geophones and cables can be strung by helicopter.

In a survey using helicopters, 16·6 profiles were covered daily with a split-spread pattern, compared with 3·4 profiles per day using ground transport. Holes were washed down to about 90 ft using light shot-hole casing. Surveying also is facilitated by the use of the helicopter. G. D. H.

178. Gulf's Airborne Magnetometer in Florida. J. E. Kastrop. *World Oil*, Aug. 1948, **128** (4), 138.—A description is given of the procedure used in operating an airborne magnetometer. The description is aided by numerous photographs.

In an average week the coverage of one crew is 2200 sq. miles, and the rate is fourteen times greater than for a ground survey, and costs 40% less.

In Florida geological conditions are unfavourable for seismic work, and it is hoped that the magnetometer may yield useful results. G. D. H.

179. Magnetometer Profile Flown from Venezuela to Texas. J. Affleck. *World Oil*, July 1948, **128** (3), 223.—In the course of returning a plane from Maracaibo to Brownsville, Texas, a flying magnetometer record was taken of the journey via Kingston, Jamaica. The flying speed was about 240 m.p.h. and the flying height 8000 ft to Kingston and 8500 ft subsequently. Flying positions were obtained by dead reckoning. No variation corrections were applied, and had the magnetic data been the primary aim of the flight the flying height would have been 2000 ft.

Maps and profiles show the magnetic data obtained. At 80 miles from Maracaibo, a sharp feature may be a fault forming the southern boundary of the Caribbean Mediterranean. Horsts and grabens may be present between 230 and 310 miles and at 360–420 miles. A substantial fault, downthrown to the south, may be present at 480 miles. 80 miles beyond Kingston an anomaly suggests a large fault downthrown to the northwest, possibly the southern edge of the Bartlett trough; the northern edge may be at 220 miles. The high separating the Bartlett trough from the Antillean sea is recognizable. G. D. H.

180. New Seismic Shooting Method Demonstrated at San Antonio. C. J. Deegan. *Oil Gas J.*, 11.11.48, **47** (28), 214.—In conventional seismic work shot-hole drilling may average 20% or more of the total cost. The shot has been placed below the weathered layer in order to get good reflections. Experiment shows that over 95% of the explosive energy in conventional shot holes is dissipated by: (1) absorption in the pulverized zone around the charge; (2) absorption of high-frequency (intensity) waves in the intermediate zone; and (3) the inverse-square-law loss due to a spherical wave front.

In the new surface-shooting technique (1) is eliminated by exploding the charges in air; (2) is minimized by spreading the energy to give a low density per unit area; and (3) is almost completely eliminated by providing a flat wave front. Charges fired 5–8 ft above the ground surface have the high-frequency waves damped by the air. The larger the charge the greater is the optimum height. The nearly flat wave front is obtained by using several small shaped charges instead of one large one. Star or hexagon patterns with thirteen or seven charges, respectively, have been used. For hard surfaces with a thin weathered zone the spacing may be 20 ft.; soft surface with thick weathered zones may need 85 ft. The combined charges may be 25% more than the single charge.

Cylindrical charges of length six to eight times the diameter and exploded from the top seem to give the best results.

Corrections for the weathered layer raise a problem.

Good reflections are said to have been obtained in the Edwards Plateau region; elsewhere the records were good or even better than with conventional shot-holes. Damage to crops is negligible. G. D. H.

181. Technique for Velocity Error Corrections. J. L. Kezeler. *World Oil*, Sept. 1948, **128** (5), 112.—A technique has been devised for confirming or correcting velocity data by means of observations made in drilling a test. Geophones are lowered down the well, and velocities measured when shots are fired at known distances from the well. Observations of this kind permit the seismic data to be re-interpreted, with the consequent possibility of defining the structures more satisfactorily than in the original interpretation, and hence money may be saved. G. D. H.

182. Aluminium Exploration Equipment Has Advantages in Gulf Coast Marshes. L. S. McCaslin. *Oil Gas J.*, 14.10.48, **47** (24), 88.—In the Gulf Coast marsh areas, aluminium has been employed for various types of truck bodies, boats, pontoons, geophysical instrument boxes, gravity-meter station platforms, and shot-hole drills. It assists exploration by reducing weights to be transported. Also it is resistant to corrosion. The aluminium drill will reach 200 ft.

Brief notes are given on the equipment and weight saved as well as on the method of welding. The use of magnesium is under consideration.

Helicopters have been used. G. D. H.

183. Patent. Texaco Development Corpn. B.P. 612,899, 1.12.48. Electric-discharge devices for use as radiation detectors. G. R. N.

Drilling.

184. Acidizing Rig Water Wells. M. M. DeWitt. *World Oil*, July 1948, **128** (3), 87.—When a water well does not provide sufficient fresh water for rig purposes, acidizing may effect a sufficient increase in production. Decrease in production of a water well may be due to: (1) precipitation when two or more different formation waters meet; (2) corrosion products of well equipment; (3) sand and sediment carried by formation water.

Usual treatment is by hydrochloric acid with inhibitors to prevent corrosion of equipment. In the case of unusual formations or conditions other additives may be used. Large quantities are generally used and forced as far as possible into the formation. The concentration used depends on the formation being treated. The well may be cleared merely by flowing or by "surging," *i.e.*, alternately injecting and producing water.

Chemicals may be used to clean well equipment pumps, etc., without removing them from the well. In this case care must be exercised in the use of inhibitors. Inhibitors must afford protection at high velocities and must satisfy requirements of toxicity, taste, odour, etc. C. G. W.

185. Diamond Bits for Deep Drilling. Anon. *Petrol. Engr*, Sept. 1948, **19** (13), 179.—In applying diamond drilling to deep holes modifications in bits and techniques were necessary. An even rate of feed and constant weight on bit are desirable but difficult to obtain on deep-well rigs. Rotational speed depends on the bit weight and the best combination of weight and speed must be found. Drilling muds are not satisfactory in conventional diamond bits, as erosion and abrasion of water courses and the matrix ensues. Redesign of bits was necessary to obtain adequate cooling, removal of cuttings, and maximum bit life when using mud as circulating fluid. For economic drilling, care must be taken of bits and the diamonds must be salvaged for re-use. Factors in the care of diamond bits are: (1) clean hole, remove all foreign objects before changing to diamond drilling; (2) keep the mud volume a minimum and constant. If fluid pressure suddenly rises, the bit has probably failed and should be replaced before the entire bit is destroyed; (3) optimum weight and speed are related, if possible operate at the optimum; (4) bring up for examination if penetration rate falls off appreciably; (5) it is essential to maintain a straight core barrel; (6) when pieces of core are left in the hole proceed carefully till the core is drilled up and the bit is seated on bottom. C. G. W.

186. Extending Rig Hose Service. C. A. Franklin and P. J. Breden. *World Oil*, Aug. 1948, **128** (4), 92.—Recommendations are made on the relative lengths of standpipe and hose—50 ft standpipe with 60 ft rotary hose are suggested. Standpipes should be braced and a surge chamber put in the line to damp pulsation. Other practices leading to maximum hose life are also discussed. C. G. W.

187. Electrical Logging Developments in the U.S.S.R. Part 6. H. Guyod. *World Oil*, Aug. 1948, **128** (4), 110.—The partial-curve-matching procedure is applicable only when $R > R_1 > R_m$.

The two-medium departure charts at present available do not seem to be accurate enough for efficient application of the partial-curve-matching method. The same remark is applicable to three-medium departure charts. While the equivalence principle can be applied to resistivity distribution of the type $R = R_m$, it has not yet been proved to apply in other cases. The departure charts discussed apply only when the bed thickness is several times the electrode spacing. The effect of electrode size and shape is probably greater than generally realized. Bed inclination seems to affect the curves obtained.

A series of diagrams show the effects of various factors on the electric-log curves. G. D. H.

188. Laboratory Tester Simulates Mud Conditions. N. E. Martello. *World Oil*, Aug. 1948, **128** (4), 98.—See Abstract No. 537 (1948).

189. New Portable Rig. G. M. Wilson. *World Oil*, July 1948, **128** (3), 71.—See Abstract No. 394 (1948).

190. Patents. British Oilfield Equipment Co. and G. Bell. B.P. 611,886, 17.11.48. Counterbalancing of the walking beams of oilwell and like pumps.

British Oilfield Equipment Co. and S. L. Witard. B.P. 611,887, 17.11.48. Protector and stabilizer sleeves or collars as employed on drill pipes.

British Oilfield Equipment Co. and S. L. Witard. B.P. 611,888, 17.11.48. Float or guide shoe or collar as employed in oilwell. G. R. N.

Production.

191. Considerations on Effective Oil Production. H. M. Ryder. *World Oil*, Aug. 1948, **128** (4), 152.—Obstructions in the pay zone can lose much oil production if the field is not planned for production, taking such obstructions into account. Such obstructions may be: (1) geological anomalies, faults, etc.; (2) absence of pay-sand bed; (3) low permeability area in the bed; (4) an area into which water has moved.

(1) and (2) may be dealt with by locating wells so that the maximum area can be flushed without crossing any obstructions.

(3) Tight areas when identified should be shot to increase the permeability. If selective shooting does not prove effective, redrilling may be necessary.

(4) Oil-wet sand into which water has moved slowly has two characteristics: (a) little additional oil can be moved by additional water flowing through the sand; (b) oil cannot be driven successfully into and through such sand.

Oil losses in this manner have been huge in the past in some fields. Examples are given, and possible reasons for the condition discussed. The only remedy lies in prevention by locating wells to avoid water-soaked areas.

References are appended. C. G. W.

192. Selective Acidizing with the Electric Pilot. J. M. Moore and R. E. Kollar. *Petrol. Engr*, Sept. 1948, **19** (13), 150.—The equipment consists of an electrode run on an insulated cable in circuit with a generator and recording instruments. Current flows only when the electrode is immersed in a conducting fluid. Using varying resistance units located at definite vertical intervals in the electrode, indicates the interface between fluids of different conductivities to within 1 ft. For use, electrode is landed in a normal seating nipple on the tubing string, located at a point above or below which it is desired to acid treat. Procedure and applications are discussed, and references appended. C. G. W.

193. Cleanout and Remedial Work. E. V. Garrett. *World Oil*, July 1948, **128** (3), 129.—Production problems in the Panhandle area consist of: (1) paraffin accumulation; (2) caving; (3) inorganic precipitates; (4) leaking or collapsed casing; (5) water intrusion.

Paraffin accumulation may be dealt with by swabbing, scraping, acid wash, hot distillate, or solvent treatments, or a combination of one or more of these. Caving may be combated by sealing the cavity formed or by gravel packing. Casing leaks are usually remedied by setting a bridge and then cementing.

Selective acidizing by packers or by the electric pilot are common practices for increasing production. Shooting is another popular practice, marble blasting in particular gaining more and more success. C. G. W.

194. Condensate Production and Cycling, Part 18. Water Injection into a Stratigraphic Trap. P. J. Jones. *World Oil*, July 1948, **128** (3), 162.—Application of reservoir and well data is illustrated by mapping out a pressure-maintenance programme by water injection. In this example optimum uniform rate of production is 12% of the in-place rich gas. C. G. W.

195. pH Determination in Condensate Well Waters. D. A. Shock. *World Oil*, July 1948, **128** (3), 141.—The major cause of corrosion in high-pressure condensate wells has been shown to be attack by carbonic acid and low-mol.-wt. fatty acids. To determine the acidity in a well a dew-point apparatus has been modified to measure pH

values. The apparatus consists of a pressure block with Arcite windows on opposite sides. The pressure chamber is observed by a mirror, in case the windows should fail. The apparatus is connected across a high-pressure separator or across the line and a water trap and tested under gas pressure and water pressure. It is then flushed out with water under near well pressure. This is to reduce the take-up of acidic constituents by iron connexions, to a minimum. Indicator is added to the vessel when full of gas after reducing the pressure, connexions are re-made and water is admitted to the vessel mixing with the indicator. The pH value is determined by colour comparison with standard buffer solutions covering the pH range 3–6·5 in steps of 0·5. Indicators used are Bromophenol Blue, Bromocresol green, Methyl red, and Chlorphenol red. Results from four fields are compared, and a definite trend for pH values to decrease as CO_2 partial pressure increases is apparent. It seems that CO_2 is largely responsible for corrosion in the field studied. References are appended. C. G. W.

196. Chromated Protein Films Inhibit Corrosion. Anon. *World Oil*, Aug. 1948, **128** (4), 162.—Constituents of these films are a corrosion inhibitor, a protein as carrier, a hardening agent, and bactericide. Usual process is a " two-steep " : the metal is dipped into aqueous protein, dried, then dipped into acidified chromate. The films are up to 0·0002 in and are very hard. They are easily removed by alkaline solutions. C. G. W.

197. Effect of Nitrogen on the Compressibility of Natural Gas, Part 2. C. K. Eilerts, H. A. Carlson, and N. B. Mullens. *World Oil*, July 1948, **128** (3), 144.—Nitrogen was mixed with natural gas in varying proportions to determine the effect of composition on compressibility. Actual volumes were as much as 3% greater than the volumes of constituents at temperatures above 32° F. The results obtained for this gas and nitrogen are believed to be applicable to other natural gases mixed with nitrogen.

Data was obtained by means of an equilibrium cell pressure range 0–5000 p.s.i., temperature range 32–280° F. Volumes at low pressures were measured accurately by a baroburette, and a steel pycnometer assembly was developed for determining single compressibility factors of the gas mixtures.

The ratio between experimental and additive volumes—the additive volume correction—were determined. Additive volumes were calculated obtaining the p-v-t data on nitrogen from literature, and on natural gas by direct measurement.

An example illustrating the use of the additive-volume correction is given. An extensive bibliography is appended. C. G. W.

198. A Study of Gun Perforating, Part 1. V. L. Forsyth. *World Oil*, Aug. 1948, **128** (4), 145.—Surface tests on identical standard test barrels, and subsurface tests were carried out to obtain some information on gun perforating. Results show : (1) high bullet velocity gives improved burr characteristics ; (2) powder charge depends on gun design ; (3) bullet size is less important than other factors ; (4) gun position has a marked effect on burr characteristic. With the gun against the casing wall or properly centred the burrs are fairly smooth ; when the gun is away from the wall or when tangential to the wall, larger burrs are formed. Burrs may be smoothed out by using caps or sleeves over the bullets ; but this reduces the penetration. Casing type has only a minor effect on the burr characteristics, but does affect the penetration. C. G. W.

199. Well-Testing Units Cut Cost. K. M. Fagin. *Petrol. Engr*, Sept. 1948, **19** (13), 174.—Such testing units include gas-trap positive-displacement liquid meter and proportional sampling device, orifice meter, and auxiliary equipment. Tests are made of gas, oil, and water production. These units have particular applications in water flood and gas repressuring projects to gauge the progress of operations. With stripper wells the unit can be used to weed out the uneconomic wells, thus reducing production costs and permitting salvaging of valuable scrap and equipment. C. G. W.

Oilfield Development.

200. Footage Much Greater in 1948. Anon. *World Oil*, Aug. 1948, **128** (4), 55.—The average depth of U.S. completions in the first half of 1948 was 3460 ft. 17,786

wells were completed giving a footage of 61,536,959 ft. In South Louisiana the depth average was 9050 ft.

Tables give by States the completions, footage, and average depths of completions in the first halves of 1947 and 1948, and the footage and completions year by year from 1934. G. D. H.

201. Five States Yield 84% of U.S.A. Production. Anon. *World Oil*, Aug. 1948, **128** (4), 45.—Twenty-four States produce oil in the U.S.A., Texas, California, Louisiana, Oklahoma, and Kansas giving 84% of the current output. Together with Illinois, Wyoming, New Mexico, Mississippi, and Arkansas, the above States give 95·8% of the output.

The current U.S. output is 5,485,900 b.d., Texas giving 2,455,300 b.d. and California 950,000 b.d.

A table gives the daily output by States for June 1941, June 1947, and June 1948. G. D. H.

202. Drilling Activity in 44 Foreign Countries Shows Gain since June. Anon. *Oil Gas J.*, 21.10.48, **47** (25), 62.—Excepting Russia and Russian-dominated countries there are 490 rigs, mostly rotary, operating in forty-four countries outside the U.S.A. 333 are in Latin America. Russia may have 500 rigs, with a further eighty-three in Russian-dominated countries.

A table shows the rig distribution by countries, with the prospective increase. G. D. H.

203. Western Canada Production Reaches New High. Anon. *World Oil*, Sept. 1948, **128** (5), 226.—In May Brazil's oil production was 10,503 brl, mainly from Candeias. Western Canada gave 983,111 brl in June. Colombia gave 1,880,667 brl in July. France's April output was 30,185 brl. In May Germany produced 360,903 brl.

A table gives the oil production of various countries outside the U.S.A. for certain months in 1948. G. D. H.

204. Canada's Production Takes Upward Turn. Anon. *World Petrol.*, Oct. 1948, **19** (11), 47.—In the first half of 1948 Canada produced 5,124,376 brl, 1,537,795 brl more than in the first half of 1947. Alberta gave 4,469,997 brl. In June Alberta's production was 900,508 brl, a record, and in this month Leduc's output of 398,829 brl exceeded that of Turner Valley (371,305 brl).

Woodbend now has five producers, but it is not yet known whether or not it is part of Leduc.

The Whitehorse refinery has been reassembled at Edmonton.

Leduc's reserves are now placed at 200 million brl.

Lloydminster is producing at the rate of over one and a quarter million brl annually. G. D. H.

205. Production Gains Reported in Brazil and Egypt. Anon. *World Oil*, Oct. 1948, **128** (6), 236.—In July Brazil produced 14,551 brl of oil, and Egypt gave 1,061,618 brl. Germany produced 348,565 brl in June, a lower output than in May.

Poland produced 80,906 brl in June. Kuwait produced 3,814,541 brl in July, and Iran 17,508,327 brl. G. D.H.

206. Kuwait Production up 28,000 Barrels Daily. Anon. *World Oil*, Nov. 1948, **128** (7), 273.—In August Kuwait averaged 151,051 b.d., while Saudi Arabia gave 422,914 b.d. Iran's production was 551,673 b.d., and Egypt's 30,242 b.d. In June Mexico gave 163,963 b.d. Canada produced 38,025 b.d. in July, 36,465 b.d. coming from Alberta and Saskatchewan. In August Trinidad produced 50,016 b.d.

A table gives oil-production data for various countries outside the U.S.A. G. D. H.

Transport and Storage.

207. Aluminium Pipe. F. E. Miller. *World Oil*, July 1948, **128** (3), 186.—Test sections of aluminium pipe have been laid to determine : (1) whether welded aluminium

can withstand normal operating pressures; (2) the resistance to various types of corrosion. A new welding technique was necessary. This maintained a blanket of inert gas round the welding zone, to prevent oxidation. The process uses A.C. 250 amps at from 82 to 90 V and weld metal must be fed into the arc as required. A back-up ring is inserted inside the pipe to prevent molten aluminium forming projections in the pipe. C. G. W.

208. First Dockside L.P.G. Terminal. J. E. Kastrop. *World Oil*, July 1948, **128** (3), 179.—Storage is provided for 46,000 brl of propane, 11,000 brl of butane, and 293,000 brl of natural gasoline. Products (received by pipeline, railroad tank cars, and trucks) are passed through vertical-pressure strainers and are metered and transferred to storage. Metering is by storage-tank gauging, or positive-displacement meters, or both. Products arriving at and delivered from the terminal are tested. Details of equipment, pumping facilities, and safety devices are given. C. G. W.

209. Mixing of Petroleum Products on Successive Pumping through the same Pipeline. V. S. Yablonskii. *Neft. Khoz.*, 1948, (10), 53–58.—A discussion giving mathematical expressions for determining the composition of mixtures in receiving tanks and for calculating when receivers should be switched for a max permissible concn of one product in another in the storage at the end of the line. The equations derived have been reduced to sets of curves, and examples indicating their use are given. V. B.

210. Reheating of Black Oils in Tank Cars. R. Paule and J. Roeder. *Rev. Inst. franc. Petrole*, 1948, **3**, 111–116, 143–148, 195–197.—Theoretical considerations show that heat-transfer between the heater and the tank contents is approx 80 cal/m²/hr/° C, the heat loss through the walls for an 18-ton car in still air amounting to 10%. The ratio initial rate of heating/final rate of heating should be about 0·5 and a min incoming steam temp of 140° C is desirable. Tables are given showing the time taken and the steam consumption to attain pumping temp (50–135° C) for various products (heavy fuel, cut-back, bitumen) in cars with different heater areas (10–20 m²) and with various available steam temp (100–250° C). Data on tank cars is also presented which shows the heat required for reheating after various cooling periods and comparison between lagged and unlagged cars. Temp–time diagrams, based on readings taken at twenty points in a 20-ton unlagged car, are given, as are isotherms showing the temp of the contents (fuel oil) at the various points in the car. Differences between the curves are more clearly marked in the case of cut-back. It is considered that further work on similar lines will give information of value in the design of new tank-car models. V. B.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

211. Fränkl Regenerator Packings. G. Lund and B. F. Dodge. *Industr. Engng Chem.*, 1948, **40** (6), 1019–1032 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology*, Dec. 1947).—Heat-transfer coeffs and pressure-drop characteristics were determined for air flowing through Fränkl regenerator packings at pressures and temps in range used for air separation. The packings and their use in air-separation plants are described. A correlation between H.T.C.s and reversal time, inlet temp, humidity, flow rate, packing geometry, and ratio of length to diam is derived and compared with general results (Dittus–Boelter relation) and with Glaser's results for Frankl packings. The applicability of results and the effect of the above variables on large-scale regenerator design were discussed. Friction factors were correlated with Reynolds No. R. G. T.

212. Heat Transfer in Recirculating Furnace. M. J. Sinnoth and C. A. Siebert. *Industr. Engng Chem.*, 1948, **40** (6), 1039–1044 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology.* Dec. 1947).—The convection coefficient of heat transfer for air to steel in a recirculating furnace at

600°, 800°, 1000°, and 1200° F is found to be independent of air–metal temp difference. The coeff increases approx as the square root of air velocity, the rate of increase decreasing above 1000° F. When used in conjunction with radiation-transfer coeffs the convection coeffs make possible the calculation of the time–temp relation for any material in such a furnace operating at a given temp. R. G. T.

213. Fin Heat Transfer by Geometrical Electrical Analogy. C. F. Kayan. *Industr. Engng Chem.*, 1948, **40** (6), 1044–1049 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology.* Dec. 1947).—Analysis of heat transfer and temp distribution through a fin integral and base material is rendered difficult by distorted temp conditions especially at base. Expected performance for different conditions of surface-conductance and material conductivity has been investigated for two fin structures by electrical analogy. Dimensionless temp-distribution relationships and relative thermal-resistance charts are used for the establishment of heat-transfer values and temp distribution. Calculated surface values are compared with those determined by electrical methods. R. G. T.

214. Heat Transfer to Granular Materials. M. S. Brinn, S. J. Friedmann, F. A. Gluckert, and R. L. Pigford. *Industr. Engng Chem.*, 1948, **40** (6), 1050–1060 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology.* Dec. 1947).—Heat-transfer values from steam-jacketed tubes to granular materials moving vertically downwards agreed closely with conductivities in stationary beds, indicating that the beds moved in rod-like flow. This was confirmed by visual observation of rod-like flow of Ottawa sand. Theoretical equations are developed, design charts are included for counter-current transfer, and equations for parallel flow are developed. R. G. T.

215. Unsteady-State Heat Transfer between Air and Loose Solids. G. O. G. Löf and R. W. Hawley. *Industr. Engng Chem.*, 1948, **40** (6), 1061–1071 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology.* Dec. 1947).—Design data in the form of unsteady-state H.T.C.s from air to a loose bed of granitic gravel are presented. Gravel, size 4 mesh to 15 in, was packed so that normal voids were obtained. Air rates of 12–66 cu. ft/min/sq. ft. cross-sectional area were used. Entering air temp was in range 100–250° F. Results were correlated and compared with previous results of Furnas and Schumann. Entering air temp has no appreciable effect on coeffs. Applicability of results to other loose solids will depend on fracture characteristics, but the above data are satisfactory unless shapes have extreme ratios of dia to length. R. G. T.

216. Heat Transfer into Cylindrical Columns of Bone Char. V. R. Deitz and H. E. Robinson. *Industr. Engng Chem.*, 1948, **40** (6), 1071–1075 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology.* Dec. 1947).—Investigation of heat transfer into bone-char shows that the temp of the char at the axis, and averaged over the cross-section of the retort, were functions of throughput, initial and wall temps, and length of retort. Approximation of an exact solution is valid over the temp range used in bone-char revivification, and has been expressed in two dimensionless curves of general applicability. Average temps of char and throughput are independent of the dia of the retort. Moisture in the char decreases the retort capacity. Thermal diffusivity values of some bone-char are reported, and experimental results are included which agree with calculated values. R. G. T.

217. Air Turbulence and Transfer Processes. E. W. Comings, J. T. Clapp, and J. F. Taylor. *Industr. Engng Chem.*, 1948, **40** (6), 1076–1082 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology.* Dec. 1947).—Effect of turbulence on heat-transfer rates was investigated in a cylinder fitted with grid-type turbulence generators. Several of the latter were used alternately to vary the turbulence. Turbulence level was measured by a hot-wire, wake-angle thermal-diffusion device upstream from experimental cylinder. Calc values of turbulence levels at position of cylinder were compared with heat and mass transfer rates over a range of Reynolds No. for cylinder from 400–20,000. For const Reynolds

No. increased turbulence increases heat transfer rate. At large Reynolds No. the effect of turbulence was greater than at small Reynolds No. Baffles increasing local velocity near cylinder were more effective in increasing the transfer rate than those arranged to increase only the level of turbulence. R. G. T.

218. Heat Transfer to Vertical Tubes in a Mixing Vessel. J. H. Rushton, R. S. Lichtmann, and L. H. Mahoney. *Industr. Engng Chem.*, 1948, **40** (6), 1082–1087 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology.* Dec. 1947).—H.T.C.s from vertical tubes in a vertical cylindrical tank equipped with flat-blade impellers have been investigated. The position of the impeller is important. For optimum heat transfer the impeller should be at half liquid depth. Mixing of suspensions may necessitate lower position of impeller. Increased rotational speeds of impeller increase H.T.C.s. R. G. T.

219. Mass and Heat Transfer in Tube Banks. C. C. Winding and A. J. Cheney. *Industr. Engng Chem.*, 1948, **40** (6), 1087–1093 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology*, Dec. 1947).—An original technique is described for determination of H.T.C.s in tube banks. Naphthalene tubes are used in various positions in dummy tube banks. Mass-transfer coeffs are obtained from the loss in weight and change in dimensions. H.T.C.s are calc using the equations of Chilton and Colburn. Experimental results compare favourably with other methods. Advantages are low cost of apparatus and accuracy of investigation where conditions vary greatly rendering single-point (thermocouple) measurements inaccurate. Thin sections cannot be used, and temps must be steady and below 50° C. Actual rates of mass transfer must be such that normal sublimation losses are negligible. R. G. T.

220. Radiative and Convective Heat Transfer Rates Pertaining to Heating Processes (Theoretical Comparison). J. Huebler. *Industr. Engng Chem.*, 1948, **40** (6), 1094–1098 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology*, Dec. 1947).—Analyses of the relative val of radiation and convection are difficult to perform because of their inseparable character. Comparison is made under ideal conditions between the effect of radiation and convection simultaneously applied. An equiv radiation coeff is used, and although the differential equations are insoluble, graphical solutions are applied. The results demonstrate that approx 20% of total heat input can be accomplished by rapid heating at high temps. The relative effect of convection increases with reduced temperature, becoming equal to that of radiation at approx 1350° F. Even at very high temps convection is not negligible and can materially affect conditions if furnace design is altered. R. G. T.

221. Heat Transfer with Extended Surface (Determination of Local Heat Transfer Coefficient from Average Coeff). C. F. Bonilla. *Industr. Engng Chem.*, 1948, **40** (6), 1098–1101 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology*, Dec. 1947).—For extended surfaces the overall average coeff based on the mean temp difference from fluid to base of fins can be computed directly. The computation of the local H.T.C. (assumed const over the whole area) is rendered difficult, since it depends on fin efficiency, which involves the coeff. A rearrangement of the relation for rectangular fins of const thickness involves the local coeff in only one dimensionless ratio $\frac{h}{h}$, which is a function of the ratio of extended to total heat-transfer surface, and a dimensionless ratio including h. $\frac{h}{h}$ has been plotted against the other two ratios so that the local coeff may be compared directly with adequate accuracy. R. G. T.

222. Heat Transfer with Extended Surface (No Mixing Parallel to Surface). W. E. Dunn, Jr., and C. F. Bonilla. *Industr. Engng Chem.*, 1948, **40** (6), 1101–1104 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology*, Dec. 1947).—Extended surface heat transfer is usually calc assuming complete instantaneous mixing occurs in the fluid throughout each plane perpendicular

to the direction of fluid flow. In practice, mixing may be poor in the direction parallel to the fins and perpendicular to the flow of fluid especially if the fins are wide. Consequently the equations for no mixing parallel to rectangular fins of const thickness are derived and integrated. Other assumptions are made, viz.: perfect mixing perpendicular to fins, no conduction in fins parallel to fluid flow or in fluid. R. G. T.

223. Applied Kinetics and Equilibria. (A Review.) O. A. Hougen. *Industr. Engng Chem.*, 1948, **40** (9), 1556–1565.—The review of applied kinetics deals primarily with problems of reaction-rate principles and data which are directly applicable to process design. Historical development, problems associated with kinetics, and recent developments in applied kinetics are reviewed. An extensive bibliography, classified according to the unit processes involved, is appended. Most references are for years following 1941.

The principles and bibliography dealing with the report on chem and physical equilibria, are classified according to phase relations. Thermodynamic properties, P.-V.-T. data for gases, general methods for correlating data, and methods of calculating activity coeffs are reported. The bibliography is extremely extensive. R. G. T.

224. Design of Temperature Measuring Elements. M. T. Cichelli. *Industr. Engng Chem.*, 1948, **40** (6), 1032–1039 (*14th Annual Meeting. Division of Industrial and Engineering Chemistry. Illinois Institute of Technology*, Dec. 1947).—Methods are described for determination of the length of temp-measuring elements that must extend into gaseous atm to reduce the error due to conduction of heat along the unit to less than a certain value. A monograph for safe design of such elements and sample calculations for most standard types of installations are included. R. G. T.

225. Patents. Aktiebolaget Separator Nobel. B.P. 608,808, 6.10.48. Sealing devices for centrifugal separators.

J. C. Arnold (Standard Oil Development Co). B.P. 609,090, 6.10.48. De-icing of refrigeration plant.

W. W. Triggs (Gilbert and Barker Mfg Co.). B.P. 609,152, 6.10.48. Oil burners.

Manchester Oil Refinery and F. Porges. B.P. 609,444–5, 13.10.48. Flow meters and density meters for liquids.

Aktiebolaget Separator Nobel. B.P. 610,482, 27.10.48. Method of centrifugal separation of sludge-containing liquids.

Peabody Ltd. (Peabody Engineering Corpn.). B.P. 611,776, 17.11.48. Fuel burners.

Anglo-Iranian Oil Co., E. W. M. Fawcett and E. S. Narracott. B.P. 612,704, 1.12.48. Processing hydrocarbons. G. R. N.

Distillation.

226. Optimum Feed Tray in Multicomponent Distillation Calculations. E. G. Scheibel and C. F. Montrose. *Industr. Engng Chem.*, 1948, **40** (8), 1398–1402.—Previous methods for determining the feed tray in multi-component distillation calculations are found to be inaccurate. Empirical equations are developed by which the ratio of light to heavy key components in the feed-tray liquid may be calculated. This ratio depends on reflux ratio and is expressed as a function of limiting values—*i.e.*, the ratio of key components in feed-tray liquid at total reflux and at almost minimum reflux. For the first case (total reflux) the ratio of keys in the feed-tray liquid is found by a simple relation. This ratio at minimum reflux has been correlated by an empirical equation based on a study of the same cases used to develop a previous empirical equation for minimum reflux in multi-component distillation. The location of the optimum feed tray by this method is compared with that determined by tray calculations on approx. eighty systems. Agreement of the results is within the accuracy of determining the latter value. The equations have been developed for conditions usually encountered in practice—they have limitations in extreme cases for feeds with less than 10% of key components and when relative volatilities of all the

components are very close (within 10%). The method eliminates the tedious trial-and-error procedure of carrying out tray-by-tray calculations with different feed-tray locations to determine which location requires the smallest total number of trays for the desired separation. R. G. T.

227. Liquid Vapour Equilibrium Relations in Binary Systems (Ethylene–*n*-Heptane System). W. B. Kay. *Industr. Engng Chem.*, 1948, **40** (8), 1459–1464.— P–V–T–X relations at the liquid–vapour boundaries for the ethylene–*n*-heptane system were obtained over the whole range of compositions. T–X diagrams for co-existing liquid and vapour phases at constant pressure enable the calculation of phase-equilibrium constants for ethylene and *n*-heptane. By comparing with other hydrocarbon systems it is concluded that the P–V–T–X relations for paraffin–olefin mixtures are nearly the same as for mixtures of paraffins, provided the olefin has the same b.p. as the paraffin which it replaces. R. G. T.

228. System 1-Butene–*n*-Butane (Compositions of Coexisting Phases). B. H. Sage and W. N. Lacey. *Industr. Engng Chem.*, 1948, **40** (7), 1299–1301.—For seventeen equilibrium states at four temps (100–280° F) the compositions of co-existing gas and liquid phases in the 1-butene–*n*-butane system were determined. The isobaric difference in mol fractions of 1-butene in the two phases was plotted as isothermal function of the mol fraction of 1-butene in the liquid phase. For temp range investigated the observed difference between the compositions of co-existing phases is less than predicted by Raoult's law. R. G. T.

229. Vapour–Liquid Equilibrium Constants for Carbon Monoxide. L. C. Widdoes and D. L. Katz. *Industr. Engng Chem.*, 1948, **40** (9), 1742–1750.—Vapour–liquid equilibrium measurements have been made on binary systems of CO and C_3H_8, C_3H_6, and $C_{10}H_{22}$, between − 7° and 190° F and 100 and 2700 p.s.i. pressure. Phase diagrams and compositions and critical points were determined for the carbon-monoxide–propane system. The constants for carbon-monoxide–propylene system are the same as for the carbon-monoxide–propane system, but are half the constants for the carbon-monoxide–decane system at 100° F. R. G. T.

Solvent Extraction and Dewaxing.

230. Dewaxing of Hydrocarbon Oils Viewed as a Solubility Problem. J. Moos and T. Haas. *Erdöl u. Kohle*, 1948, **1**, 29–38.—A review is given of solvent dewaxing processes, together with a general discussion of the basis of such methods. Data are given on the solubility of *n*-pentacosane and paraffin wax (m.p. 51·5° C) in a number of solvents; the effect on solvent power of introducing halogens (including F) into the molecule is illustrated. Among the solvents examined were *n*-alkyl thiocyanates. The system *n*-paraffin–*n*-alkyl halide is governed by similar rules to systems composed solely of hydrocarbons. Tests with thiocyanates and aliphatic alcohols show the marked effect which association has on solubility. The relationship between solubility and selectivity and the size of the solvent mol and the nature of the solvent was investigated; examples show the improvement in selectivity caused by the simultaneous employment of a second solvent. The possibility of dewaxing in the liquid phase is mentioned, but solvents in which paraffin is sufficiently insoluble for separation to be possible at a temp above the m.p. have also too small a solvent action for oils and insufficient selectivity. V. B.

Cracking.

231. Hydrocarbon Conversion at High Temperatures and Pressures. E. A. Kelso and J. A. Snyder. *Industr. Engng Chem.*, 1948, **40** (7), 1332–1336.—A pilot plant is described for research investigations of thermal or fixed-bed catalytic conversions of petroleum fractions. Value of refinery stocks may be resolved for thermal operations—coil—only naphtha reforming and steam cracking, coil-and-drum gas-oil cracking, and residuum viscosity breaking—or fixed-bed catalytic conversions, *e.g.*, polymerization, alkylation, aromatization, desulphurization, isomerization, etc. Closely controlled conditions and uniformity of charge stocks enable studies of process variables to be made. New processes can be fully assessed and developed. R. G. T.

232. Pyrolysis of Hydrocarbons. (A Review.) V. Haensel and M. J. Sterba. *Industr. Engng Chem.*, 1948, **40** (9), 1660–1669.—This review is a summary of literature in the field of hydrocarbon-decomposition reactions practised commercially in the petroleum industry. Thermal and catalytic techniques for the cracking of light hydrocarbons, processing of gasoline-range petroleum fractions (reforming), and decomposition of hydrocarbon materials heavier than gasoline are all included. Dehydrogenation of both gaseous and liquid hydrocarbons is treated as a special type of decomposition. An extensive bibliography is included. R. G. T.

233. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 608,859, 6.10.48. Regeneration of contact particles.

Universal Oil Products Co. B.P. 609,238, 13.10.48. Catalytic reforming process.

Phillips Petroleum Co. B.P. 609,321, 13.10.48. Hydrocarbon conversion.

T. O. Wilton. B.P. 610,017, 20.10.48. Processes for cracking and/or hydrogenating oils, tars, and like hydrocarbons.

J. G. Fife (Shell Development Co.). B.P. 610,080, 20.10.48. Catalyst preparation.

Bataafsche Petroleum Mij. B.P. 610,189, 27.10.48. Catalytic aromatization of aliphatic hydrocarbons.

Shell Development Co. B.P. 612,159, 24.11.48. Fluid catalyst catalytic cracking.

A. H. Stevens (Phillips Petroleum Co.). B.P. 612,423, 24.11.48. Hydrocarbon conversion.

J. C. Arnold (Standard Oil Development Co.). B.P. 612,815, 1.12.48. Stripping of deposited or adsorbed material from finely divided solids. G. R. N.

Hydrogenation.

234. Effect of Catalysts on the Hydrogenolysis of Coal. M. Pelipetz, E. M. Kuhn, S. Friedman, and H. H. Storch. *Industr. Engng Chem.*, 1948, **40** (7), 1259–1265.—Main object of investigation was elimination of asphaltenes from primary product of coal liquefaction. The liquid product is mainly liquid, has complex structure, and contains dissolved and suspended solids, the amount of which depends on degree of hydrogenation. Part of the product (*n*-hexane—insoluble) is not distillable and asphaltic in nature. The asphaltenes are produced in the first stage of hydrogenation and can be subsequently reduced to form *n*-hexane—soluble material. Fractions of the asphaltenes present heat-transfer difficulties in continuous processes. These catalysts were sought to promote hydrogenolysis of asphaltenes. Zinc–antimony catalysts were found to lower asphaltene content especially at low temps. Tin being one of best catalysts in primary cracking of coal, a combined tin and zinc–antimony catalyst was tried. This was found to enhance hydrogenation of asphaltenes and to be as efficacious in primary cracking as tin alone. 1% of catalyst was sufficient, 2% giving only slightly varying yield. The presence of a vehicle or solvent (tetralin) was considered undesirable in that production of asphaltenes is enhanced. R. G. T.

235. Production of High Cetane No. Diesel Fuels by Hydrogenation. J. A. Tilton, W. M. Smith, and W. G. Hockberger. *Industr. Engng Chem.*, 1948, **40** (7), 1269–1273.—Diesel fuels with Cetane Nos. between 70 and 80 and pour points below 30° F have been produced experimentally by high-pressure destructive hydrogenation of paraffin wax, petrolatum, paraffinic gas oil, and by saturation hydrogenation of Fischer–Tropsch Diesel fuel, synthesized with an iron-type catalyst. The fuels contain chiefly straight-chain hydrocarbons C_{10}–C_{16} per mol. Cetane Nos. of 50–55 have been produced by hydrogenation from virgin and catalytically cracked gas-oils both containing significant proportions of naphthenes and aromatic hydrocarbons. Destructive hydrogenation is shown to be superior to either thermal or catalytic cracking for production of Diesel fuels from paraffinic feedstocks. R. G. T.

236. Solvation and Hydrogenation of Coal. M. Orchin and H. H. Storch. *Industr. Engng Chem.*, 1948, **40** (8), 1385–1389.—The use of various solvents in the pressure extraction of coal at 400° C suggests a correlation between degree of liquefaction and

chem structure of solvent. High-boiling aromatics liquefy 20–30%. Readily dehydrogenated hydro-aromatics liquefy about 50%. Hydro-aromatics with a phenolic group liquefy more than 82% of the coal and are the best known solvents. The process under these solvents is thought to involve mild hydrogenolysis of C–O linkages by the hydrogen available from the solvents. Dissociation of coal and primary products are then accredited to H_2-bonding of the fragments with the hydroxylated solvent.

Liquefaction of coal with high-pressure hydrogen suggests no advantages of use of hydro-aromatics over aromatics containing phenolic groups. Suggestion is made that the effectiveness of hydro-aromatics is due partly to their ability to act as H_2 donors. The effect of phenolic groups is accredited to their superior solvating power (as evidenced in the first paragraph). R. G. T.

Polymerization.

237. Activated Bauxite as a Catalyst for Polymerization of C_4 Olefins. H. Heinemann, W. A. La Lande, Jr., and W. S. W. McCarter. *Industr. Engng Chem.*, 1948, **40** (7), 1224–1226.—The polymerization of *iso*butylene at atm pressure and 200–300° F is efficiently catalysed by activated bauxite. Its activity is increased by dehydration and temps up to approx 1400° F. Polymerization rates of *n*- and *iso*-butylene are sufficiently different to allow exclusive polymerization of the latter from mixtures by using reaction temps of 400–600° F. Mixtures of saturated and unsaturated C_4 hydrocarbons can be readily polymerized by activated bauxite at 300–500 p.s.i. After a few hours, selective polymerization of *iso*-butylene yields 60–70% per pass. Spent catalyst is regenerated by hot air to full activity. Other catalysts showed less activity and more rapid deterioration of the catalyst. Phosphoric acid was used with reasonable success, but copolymerization of C_4 olefins occurs. R. G. T.

238. Polymerization. (A Review.) C. C. Winding. *Industr. Engng Chem.*, 1948, **40** (9), 1643–1649.—The theory and methods of addition-polymerization are followed by a survey of "reaction" kinetics. Copolymerization and polycondensation reactions are discussed, and the review is concluded by an account of equipment and plant processes. The bibliography is extensive. R. G. T.

239. Patents. Bataafsche Petroleum Mij. B.P. 608,921, 6.10.48. Process of emulsion polymerization.

C. Arnold (Standard Oil Development Co.). B.P. 609,012, 6.10.48. Manufacture of hydrocarbon copolymers.

C. Arnold (Standard Oil Development Co.). B.P. 610,129, 27.10.48. Stabilized olefinic polymers and copolymers.

Distillers Co., M. D. Cooke, and J. J. P. Staudenger. B.P. 611,255–6, 10.11.48. Low-temperature polymerization of olefins.

Bataafsche Petroleum Mij. B.P. 612,331, 24.11.48. An emulsion polymerization process. G. R. N.

Alkylation.

240. Alkylation. (A Review.) R. N. Shreve. *Industr. Engng Chem.*, 1948, **40** (9), 1565–1574.—This review presents alkylation according to the method of bonding the alkyl group into the rest of the mol under the following headings—alkyl bonded to oxygen, alkyl bonded to nitrogen, alkyl bonded to carbon, alkyl bonded to other elements. Most of the applied alkylation has been in the petroleum and rubber industries, both of which applications fall in the carbon-to-carbon classification. The study and commercialization of the manufacture of alkylate for high-octane motor fuel is reviewed and presented in more detail than any other. The bibliography is extensive and covers the period 1941–48. R. G. T.

241. Methylation of Olefins with Methyl Chloride. V. A. Miller and W. G. Lovell. *Industr. Engng Chem.*, 1948, **40** (6), 1138–1150.—Hydrocarbons with highly branched structures are produced by methylation of olefins using methyl chloride in the presence

of lime. Apparatus and procedure for reaction on laboratory and semi-pilot plant scales are described. The reaction was used to produce pure triptane (2 : 2 : 3-trimethyl butane) by hydrogenation of the methylated product from trimethyl ethylene.
R. G. T.

242. Production of 2 : 3-Dimethylbutane by Alkylation. R. B. Thompson and J. A. Chenicek. *Industr. Engng Chem.*, 1948, **40** (7), 1265–1269.—Liquid $AlCl_3$–hydrocarbon complex, with ethyl-chloride promoter, catalyses the alkylation of *iso*butene with C_2H_4 to produce 2 : 3-dimethylbutane. Long life, relative cheapness, and high constant-activity level are claimed for the catalyst. 1 lb liquid $AlCl_3$, introduced as a solution in *iso*butane charge, catalyses production of 85 gal of total alkylate. Optimum conditions are given as: 110–140° F reactor temperatures, 0·5–2·5 mol.% C_2H_5Cl; 15–25 min space time (volume of catalyst in reactor at given moment per unit volume of hydrocarbons charged per minute); *iso*butane-to-ethylene ratio at least 4·5. Yield and quality of alkylate depend on composition of catalyst. R. G. T.

243. Patents.—C. Arnold (Standard Oil Development Co.). B.P. 610,186, 27.10.48. Alkylation process.

Anglo-Iranian Oil Co., A. P. Shearer, and T. Cubin. B.P. 611,905, 17.11.48. Alkylation of *iso*paraffins. G. R. N.

Isomerization.

244. Corrosion in Isomerization of Light Hydrocarbons. N. Fragen, C. W. Nysewander, and W. R. Hertwig. *Industr. Engng Chem.*, 1948, **40** (6), 1133–1137.—Corrosion in the liquid-phase isomerization of light hydrocarbons by aluminium chloride–hydrocarbon complex has been studied on laboratory and commercial scales. Rate of corrosion in the reactor varies from 1 to 5 in/year to 15 in/year at points of high turbulence. Corrosion in lines and vessels handling reaction products is about one-tenth of that in the reactor. Variation of penetration rate with catalyst turbulence, HCl concn, catalyst activity, and temp is discussed. Methods of protection of steel equipment from attack by $AlCl_3$ complex are described. R. G. T.

245. Isomerization. (A Review.) S. F. Perry. *Industr. Engng Chem.*, 1948, **40** (9), 1624–1627.—A survey of the early history and work on equilibrium relations, and reaction rate and mechanism is followed by a review of commercial processes of butane, pentane, and hexane isomerization. R. G. T.

246. Patents. A. H. Stevens (Standard Oil Co.). B.P. 610,009, 20.10.48. Isomerization of paraffin hydrocarbons.

Bataafsche Petroleum Mij. B.P. 610,223, 27.10.48. Conversion of normal butane to *iso*butane. G. R. N.

Chemical and Physical Refining.

247. Refining of Cracked Gasoline. K. K. Rumpf. *Erdöl u. Kohle*, 1948, **1**, 78–83, 109–115.—A general discussion. Particular attention is paid to sulphuric-acid refining and the reactions occurring therein. The general objects of refining treatment in the case of cracked gasoline are outlined, and characteristics such as gum and colour stability, and the relationship between bomb tests and storage stability are dealt with. Brief mention is made of the Gray vapour-phase refining process and various sweetening processes (phosphate, doctor, solutizer). V. B.

248. Desulphurization. (A Review.) H. J. Garber. *Industr. Engng Chem.*, 1948, **40** (9), 1686–1687.—In a review of several unit processes the recent literature on desulphurization is summarized. Most of this deals with desulphurization of petroleum and the methods thereof. An extensive bibliography is included. R. G. T.

249. Continuous Acid Treating Heavy Lubricating Oil. J. D. Morrison. *Oil Gas J.*, 14.10.48, **47** (24), 87.—Describes the continuous acid-treating process of lub oil used by the Sinclair Refining Co. at its Coffeyville, Kansas, plant.

Raw stocks are blended by air-blowing and temp regulated, and 98% sulphuric acid delivered by centrifugal pump into the oil stream just before entering mixer, rotameters being used to measure oil and acid. The mixer is a 12-in pipe 6 ft 8 in long, containing perforated plates spaced at 6 in apart.

A horizontal shaft carries mixing paddles which revolve edgewise, the shaft revolving at 900 r.p.m. Oil to mixer is pre-cooled. Finely divided sludge leaving mixer is coalesced by rotameter-measured water, and is settled through two tanks.

Continuous treating has resulted in 20% saving in acid consumption and 25% less sludge loss, with cleaner acid oil, less oil in sludge, and improvement in working conditions due to absence of air-blow with consequent elimination of SO_2. G. A. C.

250. Refining Action of Hydrofluoric Acid on Tar and Oil Shale Distillates. K. W. Schneider and H. Gottschall. *Erdöl u. Kohle*, 1948, **1**, 74–77.—A brief discussion of the solvent treatment of brown-coal-tar oils is followed by a review, with emphasis on German work, of the action of HF on mineral oils. Some results are given showing the polymerizing action of HF on *iso*butylene. A laboratory apparatus for the treatment of oils with liquid HF is described; use is made of elec conductivity measurements to determine the point of separation between the phases. Numerous treatments were carried out on a gas oil from brown-coal tar to determine the influence of temp, contact time, and solvent ratio. Suitable conditions are an acid–oil ratio of 1 : 2, a reaction time of 75 min at 20° C, with 15 min settling. As well as exerting a refining action on the gas oil, with increase in Cetane No. and a very marked lowering of S content, there is also a polymerizing action yielding a medium-quality lub oil. The solvent action of HF is especially marked on O-, N-, and S-containing compounds and olefins, whilst the solubility of paraffins, naphthenes, and aromatics is only slight. The total raffinate yield is 45–60%, but use can be made of the extract (resins, drying oil, fuel). The principal constants of the various products are given. V. B.

251. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 610,187, 27.10.48. The adsorptive separation of straight chain from branch chain paraffins.

C. Arnold (Standard Oil Development Co.). B.P. 610,188, 27.10.48. Separation of diolefins from hydrocarbon mixtures.

Anglo-Iranian Oil Co., E. W. M. Fawcett, and E. S. Narracott. B.P. 610,703, 3.11.48. Processing of hydrocarbons.

Anglo-Iranian Oil Co., L. C. Strang, and J. Owen. B.P. 612,006, 17.11.48. Refining of hydrocarbons. G. R. N.

Special Processes.

252. Combustion. (A Review.) B. Lewis and G. von Elbe. *Industr. Engng Chem.*, 1948, **40** (9), 1590–1596.—The more important unclassified developments in fundamental research and various technical developments which have taken place during and after the Second World War are reviewed. Investigations on gaseous combustion, Otto engines, diesel engines, gas turbines, jet propulsion, high explosives, furnaces, and fundamental investigations of the burning of carbon are included. The bibliography is extensive. R. G. T.

253. Combustion with Oxygen and Oxygen-Enriched Air.—Part I. Thermodynamic Data and their Implications for High-Temperature Heating Processes. H. R. Fehling. *J. Inst. Fuel*, 1948, **21**, 221.—Combustion with oxygen differs in kind as well as in degree from combustion with air. Volumetric and thermal data for combustion with pure oxygen are derived from stoichiometric relations and tabulated for various fuels. Oxygen flames are usually affected by dissociation of "combustion gas" (products of combustion) which occurs above 2000° C. The dissociation of CO_2, H_2O, and combustion gas is discussed in detail. Dilatation (expansion) of combustion gas due to dissociation was also investigated and found to vary widely with temp, but not for different fuels. The relation between heat content per unit vol and temp (It.-diagrams) are presented for common solid, liquid, and gaseous fuels, and maximum combustion temps are worked out from these.

The main objects of oxygen-enrichment are increased thermal efficiency and rate of

heat transmission. The influence of oxygen-enrichment on these two characteristics is discussed. Maximum efficiencies for a furnace operating above 1500° C are found to vary for various fuels. Maximum degree of oxygen enrichment is controlled by the ratio of oxygen to waste gas vol for combustion with pure oxygen. Use of oxygen was previously limited by misguided fear of overheating the furnace structure. The main consideration is the proportion of heat input which reaches the charge. If more heat can reach charge by convection, regenerators become superfluous and many advantages accrue. The effect of enrichment on radiation is mostly conjecture.
R. G. T.

254. Advances in Hydrocarbon Synthesis (Fischer–Tropsch). F. Martin. *Erdöl u. Kohle*, 1948, **1**, 26–29.—A review of recent developments dealing with gas purification, and especially with the effect of variations in the catalyst on the products obtained and on operating conditions. The present trend is to use the Fischer–Tropsch reaction rather as a source of chemicals and solvents than as a means of producing gasoline.
V. B.

255. Friedel–Crafts Reactions. (A Review.) P. H. Groggins. *Industr. Engng Chem.*, 1948, **40** (9), 1608–1610.—The mechanism and thermodynamics of Friedel–Crafts reactions are first reviewed. The rest of the survey is devoted to acylations, miscellaneous reactions, and industrial operations involving Friedel–Crafts catalysts.
R. G. T.

256. Application of Fluidizing Methods for Solids to Non-Catalytic Processes. B. de Resseguier. *Rev. Inst. franç. Pétrole*, 1948, **3**, D97–D98. A brief bibliographical survey.
V. B.

257. Fluorine Disposal (Continuous Process). R. Landau and R. Rosen. *Industr. Engng Chem.*, 1948, **40** (8), 1389–1393.—The use of caustic soda as an adsorbent was practised on an industrial scale to remove large quantities of fluorine and its usual admixtures with HF and gaseous fluorocarbons, and nitrogen. Relative simplicity, continuous operation, and continuous regeneration of caustic soda with lime are described. Contamination of effluent water by fluoride is prevented by gravity settling of CaF_2. Other potential uses, *viz.*, handling acidic gases, *e.g.*, CO_2, are suggested.
R. G. T.

258. Air Entrainment in Gas Burners. G. von Elbe and J. Grumer. *Industr. Engng Chem.*, 1948, **40** (6), 1123–1129.—An experimental and theoretical study has been made of the air entrainment in gas burners consisting of a free jet of gas in air and either a cylindrical burner tube or a Venturi duct which leads to a manifold of small flame ports. An equation has been derived for cylindrical burner tubes assuming that part of the stream momentum is transformed into static pressure corresponding to the resistance offered by friction, buoyancy, and the back pressure of the flame. The relation between air entrainment, burner dimensions, position, and gas flow agrees well with experimental data. Fluctuations in the entrainment in cylindrical burners are found to be inherent in the entrainment process.

Venturi ducts are used when the flame is to be distributed over a number of ports, since stream momentum must be converted into static pressure. For the Venturi duct the equation of air entrainment can be derived assuming Bernoulli's theorem is valid. To study the non-ideal conditions causing lower entrainment than predicted values, an energy balance of flow between throat and head of a test burner has been made by separate measurement of potential energy and kinetic energy corresponding to average velocity and velocity profile. The latter contribution is lost between throat and head in the form of eddies.
R. G. T.

259. Oxidation. (A Review.) L. F. Marek. *Industr. Engng Chem.*, 1948, **40** (9), 1635–1642.—The many operations in which oxidation plays a major part are reviewed. Work on oxidation of aliphatic and aromatic hydrocarbons, alcohols, and other fuels is then described. Oxidizing agents include peroxides, selenium dioxide, nitric acid, sulphonation followed by nitric acid, nitrogen tetroxide, chlorites, chlorates, chromic acid, and similar compounds. Recent developments in large-scale production of

oxygen and its major uses are described. The review is completed by a survey of recent work on reaction kinetics. The bibliography is extensive. R. G. T.

260. Patents. Bataafsche Petroleum Mij. B.P. 610,421, 27.10.48. Process and apparatus for carrying out exothermic catalytic reactions in the vapour phase.

Anglo-Iranian Oil Co., S. F. Birch, F. A. Fidler, and O. M. K. Collis. B.P. 612,390, 24.11.48. Production of *cyclo*hexane. G. R. N.

Metering and Control.

261. Flow Measurements of Small Quantities of Oil by Means of Orifices. C. Schmid and K. W. Schneider. *Erdöl u. Kohle*, 1948, **1**, 199–200.—Tests were carried out with the double-bevel orifice suggested by Witte (*Z. Ver. dtsch. Ing.*, 1943, **87**, 289) and which he states is effective in the Reynolds No. range 55–20,000. Three orifices were tested having $d = 8{\cdot}7$, 6·0, and 3·7 mm in tubes having $D = 25$, 25, and 12 mm respectively. Three crude oils were used as the test liquids. Results showed that discharge coeff were obtained which were constant for Reynolds No. above a very small value, which can be as low as 20 if an error of $\pm 2\%$ in flow measurement is permissible. With such small orifices, individual calibration is necessary. V. B.

Products.

Chemistry and Physics.

262. Structure of a Catalyst Surface. R. Sips. *J. chem. Phys.*, 1948, **16**, 490–495.—A method is described which makes it possible to calculate rigorously the distribution of the adsorption energies of the sites of a catalyst surface when the adsorption isotherms are known, if the adsorption is localized and there are no interactions. This method is applied to a Freundlich isotherm and also to a new theoretical isotherm which reduces to the Freundlich type for small pressures, but exhibits saturation for large pressures. It is shown that this isotherm corresponds to a distribution function which differs very little from a Gaussian one. The case of atomic adsorption is also considered. A. R. W. B.

263. Mechanism of Flame Propagation. M. F. Hoare and J. W. Linnett. *J. chem. Phys.*, 1948, **16**, 747–749.—It has been shown recently that for a number of carbon-monoxide flames the burning velocity increases as the calculated equilibrium concentration of hydrogen atoms in the flame front increases. It is shown in this paper that, by combining calculated ignition and flame temperatures, the variation in burning velocity with composition can also be accounted for on an essentially thermal theory of flame propagation. A. R. W. B.

264. Vapour Pressure and Heat of Sublimation of Graphite. L. Brewer, P. W. Gilles, and F. A. Jenkins. *J. chem. Phys.*, 1948, **16**, 797–807.—The heat of sublimation of graphite and the heats of dissociation of C_2 and CO have been unambiguously established by the determination of the total vapour pressure of graphite by an equilibrium effusion method and by the determination of the partial pressure of C_3 (gas) in equilibrium with graphite. A. R. W. B.

265. Catalytic Isomerization of Butene-1 to Butene-2. J. Turkevich and R. K. Smith. *J. chem. Phys.*, 1948, **16**, 466.—A study has been made of the interconversion of butene-1 and butene-2 on both liquid and solid catalysts. Parallel work studying the exchange of radioactive hydrogen and tritium between the catalysts and the hydrocarbons, butene, propylene, and ethylene, was also undertaken. A mechanism based on hydrogen transfer by the catalyst is proposed to explain the results, and this mechanism is extended to apply to the action of catalysts in alkylation, cracking, and polymerization reactions. This mechanism is fully discussed. A. R. W. B.

266. Geometry of CH_2X Molecules. H. A. Skinner. *J. chem. Phys.*, 1948, **16**, 553.—Experimental data are given in a summarized form, and it is stated that although these

do not include the possibility that the CH_3 groups in the methyl halides are slightly "flat," it seems unlikely that the extent of their flattening amounts to more than two or three degrees. Moreover, it would seem that those factors which might be expected to flatten the CH_3 group are either small in themselves or are offset in their effect by steric repulsion between the H and X atoms. A. R. W. B.

267. Some Properties of Hydrocarbons Having more than Twenty Carbon Atoms. W. M. Mazee. *Rec. Trav. chim. Pays-Bas*, 1948, 197–213; *Rev. Inst. franç. Pétrole*, 1948, **3**, D102.—Numerical data are given on the heat of fusion, heat of transition, sp.ht., mol refraction, b.p. at reduced pressure, heat of vaporization, and visc of a number of branched alkanes and of cyclanes having >20 C atoms. Details are also given regarding the crystallographic properties of *n*-heneicosane and *n*-tetracosane. V. B.

268. Infra-Red and Raman Spectra of Heavy *cyclo*Octatetrene. E. R. Lippincott, R. C. Lord, and R. S. McDonald. *J. chem. Phys.*, 1948, **16**, 548. A preliminary report of the vibrational spectra of completely deuterated *cyclo*octatetrene [C_8D_8] prepared by the polymerization of acetylene. A. R. W. B.

269. Isomerization of Saturated Hydrocarbons. V. H. Pines, B. M. Abraham, and V. N. Ipatieff. *J. Amer. Chem. Soc.*, 1948, **70**, 1742.—The reversible isomerization of methyl*cyclo*pentane to *cyclo*hexane in the presence of $AlBr_3$–HBr catalyst has been studied using high-vacuum technique. It was found that under certain controlled conditions methyl*cyclo*pentane does not undergo isomerization to *cyclo*hexane unless *cyclo*hexene or *cyclo*hexyl bromide in amounts of about 0·05 mol % or higher are present. G. R. N.

270. Oxidation Behaviour of Hydrocarbons. III. Oxidation of Naphthenes. C. Kröger, K. Strüber, and C. Umland. *Erdöl u. Kohle*, 1948, **1**, 241–246.—Extensive experiments were carried out on the oxidn of decalin in the authors' previously described O_2-circulation apparatus. The O_2 absorption of decalin was measured in the temp range 120–150° C, and the resultant curves show the decrease in induction period with rising temp. The temp coeff of the reaction and the heat of activation were determined. A detailed examination of the oxidn products was made, and the proportion of O_2 absorbed in the formation of each was determined, with the following results (% of O_2 absorbed): water (40·2), resin (24·4), phthalic acid (14·9), CO_2 (10·0), formic acid (9·3), and CO (0·6). The resin (the main oxidn product) was examined and found to be a very stable resistant material; it is thought to be a polymer of the formula $(C_{10}H_{14}O_3)_n$, and a structure based on polymerized hexalin and hexalin peroxide is suggested. A reaction mechanism for the oxidn of decalin in the liquid phase is proposed. The effect of a considerable number of additives, principally metals and metallic oxides, on the oxidn of decalin was studied. The catalytic activity observed decreased in the order Cu, Ag, Ni, Pb, Zn, Al, Mn, whilst Sn had an inhibitory action. It is pointed out that catalytic activity depends on the hydrocarbon being oxidized, since in similar experiments using cetane, Pb and Cu showed marked inhibitory action whilst Sn was a good catalyst. Benzaldehyde was a catalyst for decalin oxidn. V. B.

271. Alkylation of Thiophene with Olefins. W. G. Appleby, A. F. Sartor, S. H. Lee, Jr., and S. W. Kapranos. *J. Amer. chem. Soc.*, 1948, **70**, 1552.—Alkylthiophenes were prepared by direct alkylation of thiophene with *iso*butylene and propylene over a phosphoric-acid polymerization catalyst. Alkylation was predominantly in the 2-position, although high yields of the 3-isomer were obtained. The physical properties and absorption spectra of several of the alkyl thiophenes were determined. G. R. N.

272. Solubility of Water in Hydrocarbons. C. Black, G. G. Joris, and H. S. Taylor. *J. chem. Phys.*, 1948, **16**, 537–543.—Tritium oxide is used as a tracer in the determination of the solubility of water in a number of paraffinic, olefinic, and diolefinic hydrocarbons. The effect of temperature, pressure, size of hydrocarbon molecule, and the constitutive factors have been studied, and also solubilities in the temperature range 5–30° C at pressures from 1 to 6 atm. A. R. W. B.

273. Hysteresis of the Contact Angle. S. J. Gregg. *J. chem. Phys.*, 1948, **16**, 549.—The factors causing hysteresis are discussed, and it is concluded that in principle hysteresis may be eliminated in all cases where impurities are absent by allowing sufficient time to elapse before taking measurements of θ. However, judging from common experience, the author states that, under conditions attainable in practice, it seems that in a residue of cases, hysteresis of the contact angle will persist despite the most careful precautions. A. R. W. B.

274. Ignition of Explosive Gas Mixtures by Electric Sparks. Minimum Ignition Energies. R. Viallard. *J. chem. Phys.*, 1948, **16**, 555.—The contradictory experimental evidence of Lewis, von Elbe *et al.*, and the author on the subject of minimum energies for the ignition of explosive-gas mixtures are discussed, and some suggestions are put forward to reconcile the two sets of results. A. R. W. B.

275. Consideration of the Gibbs Theory of Surface Tension. R. C. Tolman. *J. chem. Phys.*, 1948, **16**, 758–774.—The Gibbs theory of surface tension is discussed in detail. Consideration is given to the structure of transition layers between phases and this provides theoretical information as to the magnitude of surface tension and as to the location of the surface of tension, which can be used in making applications of the Gibbs theory. A. R. W. B.

276. A Theory of Vapour Pressures of Liquids based on Van der Wall's Equation of State. F. R. Wall. *J. chem. Phys.*, 1948, **16**, 508–512.—An expression is deduced for the vapour pressure of a liquid assuming the validity of Van der Waals' equation. The vapour-pressure equation so obtained can be put into a reduced form, which is of a universal nature. The laws of Guldberg and Guye and of Trouton are shown to be compatible with the theory which gives constants of the correct order of magnitude for these equations. A. R. W. B.

Analysis and Testing.

277. Determination of Aromatics and Olefins in Hydrocarbon Mixtures. C. Berg and F. D. Parker. *Anal. Chem.*, 1948, **20**, 456.—A modified acid-solubility method offers improved accuracy in the determination of aromatics and olefins in hydrocarbon mixtures. The test is carried out by adding 15% fuming sulphuric acid to a solution of the sample in glacial acetic acid. Tests on various known mixtures have determined the optimum glacial acetic acid–fuming sulphuric acid ratio and have shown the method to be superior to the 98%-sulphuric-acid method. It is simple and rapid, and errors due to incomplete solution of olefins and partial solution of saturates have been considerably reduced. G. R. N.

278. Determination of Aromatics in Petroleum Products. A. L. Conrad. *Anal. Chem.*, 1948, **20**, 725.—A chromatographic method is described for use with hydrocarbon mixtures such as gasoline and kerosine. It utilizes a combination of silica-gel separation and ultra-violet-stimulated fluorescence. A linear ratio between the two zones of differing fluorescence in the silica-gel column is shown to be directly proportional to the aromatic content. The method is reproducible to within $\pm 2\%$; olefins and other hydrocarbons do not interfere. G. R. N.

279. Determination of Total Aromatic plus Olefin. I. W. Mells, S. S. Kurtz, Jr., A. H. A. Heyn, and M. R. Lipkin. *Anal. Chem.*, 1948, **20**, 333.—A method is described for the determination of the total olefin and aromatic content of hydrocarbon mixtures in the gasoline and kerosine boiling range by absorption in sulphuric acid containing 30% by weight of phosphorus pentoxide. It consists of treating the sample with the sulphonation mixture at ice temperature which converts the olefins and aromatics to acid-soluble compounds and leaves the paraffins and naphthenes in a separate phase that can be measured quantitatively. The method has been incorporated in A. S. T. M. tentative method D875–46T. G. R. N.

280. Determination of Asphaltenes, Oils and Resins in Asphalt. R. L. Hubbard and K. E. Stanfield. *Anal. Chem.*, 1948, **20**, 460.—A method is described for the quantita-

tive determination of the three groups of constituents—asphaltenes, oils, and resins—in petroleum and native asphalts. The asphaltene (benzene-soluble, pentane-insoluble) fraction is obtained by extracting the asphalt with *n*-pentane. The pentane-soluble portion is further fractionated by adsorption on anhydrous alumina and extraction, first with pentane to obtain the oil fraction and then with a methanol–benzene solution to obtain the resin fraction. The three asphalt constituents are recovered and may be used for further study. A complete analysis can be made in 8 hr after the sample has been dispersed in pentane and allowed to stand approximately 12 hr or overnight.
G. R. N.

281. Bromine Addition Numbers. H. H. Dubois and D. A. Skoog. *Anal. Chem.*, 1948, **20**, 624.—To measure the olefin content of hydrocarbon mixtures an electrometric method for the determination of bromene addition numbers was developed for routine work. The procedure involves direct titration with the stable potassium bromide–bromate reagent. A catalyst (mercuric chloride) is used to increase the reaction rate, and cooling is employed to reduce substitution to a minimum. Advantages cited are, only a single stable standard reagent is used and the presence of dark-coloured material causes no interference.
G. R. N.

282. Evaluation of Catalysts for Catalytic Cracking. A. R. Rescorla, J. H. Ottenweller, and R. S. Freeman. *Anal. Chem.*, 1948, **20**, 196.—A group of physical and chemical analyses is discussed, to be used for the evaluation of catalyst in fluid-catalytic-cracking units. These include density (aerated, freely settled, compacted, and pressure), roller-particle analysis, sieve analysis, routine quantitative analysis, surface area measurement (by potassium-hydroxide adsorption, aromatic adsorption, and nitrogen adsorption), and activity tests by the U.O.P., Houdry, Jersey D + L, and Kellogg methods.
G. R. N.

283. Measurement of Heat of Combustion of Volatile Hydrocarbons. R. L. Le Journeau and R. Matteson. *Anal. Chem.*, 1948, **20**, 663.—A sample holder having advantages over existing liquid sample-handling techniques, for holding low-boiling liquid fuels in determining the heat of combustion is described. Typical results are given for pure hydrocarbons and production-grade motor and aviation fuels. *iso*Pentane is securely held at 25° C, only 3° C below its boiling point.
G. R. N.

284. Purity of Di*cyclo*pentadiene Concentrates. G. C. Ray. *Anal. Chem.*, 1948, **20**, 331.—A cryoscopic method is described for determining the di*cyclo*pentadiene content of concentrates having purities of the order of 50–80%. Analyses of synthetic samples and of concentrates produced from certain hydrocarbon-cracking operations indicate that accuracies of the order of 1–2% can be obtained. Within the limits of experimental error solid-solution behaviour was not observed. High-purity di*cyclo*pentadiene is used as the cryoscopic solvent.
G. R. N.

285. Laboratory Evaluation of Oil Deterioration. R. G. Larsen. *Anal. Chem.*, 1948, **20**, 547.—Detailed consideration is given to the physico-chemical variables involved in the deterioration of engine, turbine, and transformer oils and those factors which are significant in service. It is possible to establish the conditions most suitable for laboratory tests. Behaviour of engine lubricants in the ring-belt area cannot be studied in tests designed for measuring crankcase-oil stability, but the investigation requires specially adapted high-temperature experiments. Limitations are discussed as well as difficulties in correlating test results with field data. It is concluded that laboratory methods should be employed not so much to predict the useful life of an oil as to provide a relative rating and information as to the fundamental chemical nature of a series of oils.
G. R. N.

286. Hydrocarbon Analysis. III. The Accurate Distillation of Liquid Hydrocarbons. H. Grosse-Oetringhaus. *Erdöl u. Kohle*, 1948, **1**, 273–280.—A description of laboratory-scale dist apparatus for accurate fractionation. The column is packed with wire and is encased in a silvered vac jacket. The recommended reflux ratio is 20 : 1, and the dist rate 90–100 sec/ml. A scheme is given for the analysis of gasolines by separating into fractions and examining these by chemical methods (iodine val, diene

val, H_2SO_4 extraction) as well as by physical tests (mol. wt., an. pt.) thus enabling the proportions of saturated and unsaturated constituents to be determined. Results of the analysis of three gasolines are given as examples. For exact separation into fractions of equal number of C atoms, it is preferable previously to hydrogenate the gasoline; by extending the column, dist of such hydrogenated gasolines can be carried out with sufficient accuracy to separate *n*- and *iso*-paraffins. By a suitable addition of condensing equipment C_4 fractions can be recovered. V. B.

287. Apparatus for Continuous High-vacuum Distillation. M. Louis. *Rev. Inst. franç. Pétrole*, 1948, **3**, 192–194.—A laboratory glass cascade still is described consisting of an inclined tube 80 mm dia and 1 m long partitioned into six divisions, preceded by a vessel for preliminary degasification of the charge under moderate temp and vac. Each electrically heated compartment is fitted with a condenser and receiver. The apparatus is continuous in operation and gives a throughput of approx 1 l/hr. Test results on the fractional dist of a transformer oil are given, including subsequent further fractionation by solvent (acetone and acetone–water) extraction. V. B.

288. Routine Vacuum Distillation of Heavy Petroleum Products. N. F. Bogdanov. *Neft. Khoz.*, 1948, (10), 48–53.—Boiling range is considered as an important characteristic in the production control of lub. oil and similar fractions. A simple laboratory apparatus is described for carrying out routine dist on 100 ml of sample at a pressure of approx 1 mm. It is suitable for products having a b.p. (at) of 250–525° C, and a test can be made in 1–1½ hr with good reproducibility. V. B.

289. Helical Packing for Small Laboratory Distilling Columns. F. W. Mitchell and J. M. O'Gorman. *Anal. Chem.*, 1948, **20**, 315.—The packing is made of continuous wire helices wound about a centre core, and combines ease of fabrication, low operating hold-up, and high efficiency. The method of construction is described, and the results of operational tests are presented. G. R. N.

290. Depolymerization of Butylene Polymers. F. G. Ciapetta, S. J. Macuga, and L. N. Leum. *Anal. Chem.*, 1948, **20**, 699.—In a study of the catalytic depolymerization of butylene polymers over Attapulgus clay, several analyses of octene feed and products of the experiments were needed in order to determine the extent and the manner in which some of the original compounds were isomerized over the catalyst. The method employed consisted of hydrogenation to the corresponding paraffins, fractional distillation, and analysis of the fractions by means of the mass spectrometer. The analytical data are presented, and the method of arriving at the various carbon-structure isomerizations occurring in two typical experiments employing cold acid polymer and a codemer made over U.O.P. phosphoric-acid catalyst, respectively, is described in detail. G. R. N.

291. Double Bond Index. M. R. Lipkin, A. Sankin, and C. C. Martin. *Anal. Chem.*, 1948, **20**, 598.—Double-bond index (D.B.I.) is defined by the equation

$$\mathrm{DBI} = \frac{(\delta - 98)(M + 17)}{3190Q}$$

where δ is specific dispersion for the F and C lines of hydrogen, M is mol. wt., and Q is the number of double bonds per mol. D.B.I. is useful in identifying the predominant type of aromatic or olefinic hydrocarbon in a petroleum fraction regardless of the presence of paraffins and naphthenes. The data necessary are specific dispersion; mol. wt., which can be obtained either from density and mid-boiling point or from viscosities at 100° F and 210° F; and number of double bonds per mol, which can be calculated from percentage hydrogen before and after complete hydrogenation of the sample. At present this correlation is regarded as a research tool. G. R. N.

292. Determination of Ethylacetylene and Vinylacetylene in C_4 Hydrocarbon Gases. P. R. Thomas, L. Donn, and H. C. Becker. *Anal. Chem.*, 1948, **20**, 209.—Total acetylenes are determined from the acidity produced on treatment of a sample with 2·5% silver-nitrate solution. Catalytic hydrogenation is used to differentiate between ethylacetylene and vinylacetylene after corrections have been made for the hydrogen

consumed by the olefins and 1 : 3-butadiene. Olefins plus 1 : 3-butadiene are determined by bromine addition, and 1 : 3-butadiene by use of maleic anhydride. Ethylacetylene and vinylacetylene are determined with an average deviation of 0·8% on the basis of the total sample over a concentration range from 1–100%. Methylamine and methyl mercaptan interfere, and, if present, must be removed. 1 : 2-Butadiene also interferes, but no chemical method is available for its determination. The percentage of vinylacetylene will be increased, and consequently the ethylacetylene will be decreased by the amount of 1 : 2-butadiene that is present. G. R. N.

293. Determination of Ignition Temperatures of Combustible Liquids and Gases.—G. S. Scott, G. W. Jones, and F. E. Scott. *Anal. Chem.*, 1948, **20**, 238.—A stainless-steel block, heated electrically, and containing a 125-cc Pyrex flask in the centre is substituted for a liquid bath for the determination of the minimum ignition temperatures of liquids and gases by the drop method. The gases are liquefied by means of dry ice or liquid nitrogen before testing. Lower minimum ignition temperatures are obtained in this apparatus than in the liquid baths by a closer approach to black-body conditions. Selected ignition temperatures for 172 compounds are given. G. R. N.

294. Determination of Trace Impurities in Reference Fuel Grade *iso*Octane. J. A. Anderson, Jr. *Anal. Chem.*, 1948, **20**, 801.—Infra-red absorption spectroscopy is used to determine trace quantities of impurities present in reference fuel grade *iso*octane of 99·5% purity prepared commercially by continuous fractional distillation of butylene alkylate. The method is useful for fractionating-tower control purposes in plant operation for the determination of the relative content of the less volatile and more volatile impurities present with the *iso*octane product. It is accurate to $\pm$ 0·1% for the total concentrations of low-boiling impurities, high-boiling impurities, and total impurities. G. R. N.

295. Identification of Pennsylvanian Lubricating Oils. R. E. Hersh, M. R. Fenske, H. G. Matson, E. F. Koch, E. R. Booser, and W. G. Braun. *Anal. Chem.*, 1948, **20**, 434.—Extensive surveys of the lub. oils derived from various crude oils indicate that distillate fractions from Penna oils, in general, have lower optical activity than those of oils from other crude sources. Penna lub. oils show a more definite absorption band in the infra-red region at 10·3 μ, and when clay-filtered in a standard manner they show a higher rate of change in absorption with wavelength in the ultra-violet region around 250 mμ than oils from other crude sources. Procedures utilizing these characteristics and other properties relating to composition are suggested for identifying Penna oils and carrying out comparative studies regarding the source and recognition of oils or crudes. The methods using optical activity and ultra-violet absorption are to a large extent independent of the previous history of the oil and the presence of additives. G. R. N.

296. Determination of Olefins in Gasoline. R. W. B. Johnston, W. G. Appleby, and M. O. Baker. *Anal. Chem.*, 1948, **20**, 805.—In many hydrocarbon mixtures it is desirable not only to ascertain the total olefin concentration but to differentiate among the olefins as to double-bond position. This is particularly true where the double-bond position can be related to gasoline quality. A method is described to differentiate olefins having alpha and internal double bonds respectively. The analytical technique makes use of the characteristic mono-olefin absorption bands in the 9·5–11·5μ region and a silica-gel-adsorption technique for removing saturate and aromatic interference. Calibration curves are presented for a number of pure olefins at the characteristic wavelengths to demonstrate the absorption similarity of olefins of the same type. The method is applied to a number of refinery products such as catalytically and thermally cracked gasolines and reformed gasoline. G. R. N.

297. Determination of Oxidation Products in Gasolines. O. Widmaier and F. Mauss. *Rev. Inst. franç. Pétrole*, 1948, **3**, 151–160, 183–191.—Published methods for the estimation of peroxides, aldehydes, and acids in gasolines are critically reviewed. A modification of the Yule and Wilson method for peroxides (*Industr. Engng Chem.*, 1931, **23**, 1257) is suggested on the basis of tests made with known concn of synthesized peroxides using a variety of diluting solvents. The solution used was 5 g NH_4CNS

5 g $FeSO_4$, 500 ml EtOH, 500 ml H_2O, 5 ml H_2SO_4 (conc), stored over iron wire in an atmosphere of N_2. The iron wire is removed as soon as any ferric salts have been reduced, as shown by loss of colour of the solution. The titanous-chloride solution is stored in an N_2 atm, and a special burette for this purpose is described. 10 ml of gasoline is agitated for 5 min in a stoppered flask with 50 ml of the reducing solution. Using EtOH the solution is diluted till, on a 10 ml sample withdrawn for test, the peroxide No. (ml $N/100$ $TiCl_3$) is <1. The method can also be applied to used lub. oils. For aldehyde estimation a variation of the Reclair and Frank hydroxylamine-hydrochloride method (*Perfum. Essent. Oil*, 1938, **29**, 212) is proposed, based on trials in which the influence of various factors on the test results was determined. 5 ml of the gasoline is shaken with 15 ml of a 0·5% $NH_2OH.HCl$ solution and 10 ml of EtOH at 15–20° C. The HCl liberated is titrated with $N/10$ KOH using methyl orange. Practice is required to observe the endpoint, even with the aid of a blank for comparison. Dilution with a hydrocarbon solvent is necessary if the titration figure is >5 ml. Tests on the analysis of gasolines simultaneously containing peroxides, aldehydes, and acids indicate that the above methods, together with titration of the acidity with $N/10$ KOH, give in such cases accurate peroxide contents and satisfactory approximations for the aldehyde and acid content, provided that delay in testing is avoided, since storage of the sample will distort the results. Forty-one references.

V. B.

298. Petroleum Solvents. W. T. Harvey and I. W. Mells. *Anal. Chem.*, 1948, **20**, 207.—A correlation was developed, which relates the A.P.I. gravity, 50% boiling point (° F), and aniline point (° F) with kauri-butanol-solvency values of petroleum solvents. This relation is expressed mathematically by two equations, one applying to solvents below 50 kauri value, the other applying to higher-solvency materials.

G. R. N.

299. Quantitative Analysis of Ternary Mixtures of Butane, *iso*-Butane, and Propane. T. Reis. *Pub. Tech. et Scient. Ecole franç. Ingénieurs, Beyrouth*, 1944, No. 6; *Rev. Inst. franç. Pétrole*, 1948, **3**, D104.—A simple method is suggested, based on the v.p. and density of the gas mixture at 15° C. A nomograph for this purpose is given. Any contraction occurring on mixing is ignored, since the errors due to this cause are unimportant. The method is limited to gaseous hydrocarbon mixtures consisting solely of paraffins.

V. B.

300. Rapid Evaluation of Solvent Extraction Processes. H. A. Bewick, J. E. Currah, and F. E. Beamish. *Anal. Chem.*, 1948, **20**, 740.—A convenient continuous liquid–liquid extractor for evaluation of solvent-extraction processes and for routine analytical procedures may be used with solvents heavier or lighter than the extracted liquid. A new value, the half-extraction volume, for the comparison of the efficiency of continuous extractions is described. The half-extraction volume is related to the distribution factor and is easily and rapidly determined. The characteristics of the extraction during the entire course of the operation may be followed.

G. R. N.

301. Rapid Determination of Specific Gravity of Liquids under Pressure. J. I. Lacey. *Anal. Chem.*, 1948, **20**, 379.—The sample is placed in a high-pressure vessel fitted with a sight glass, and the specific gravity is read by means of a hydrometer floating in the liquid.

G. R. N.

302. Spectrographic Determination of Sodium in a Silica–Alumina Catalyst. J. B. Marling. *Anal. Chem.*, 1948, **20**, 299.—The method described involves the use of a copper counter-electrode to provide reference lines, and is especially suited for analyses in which an internal standard is not available. Determinations of the sodium content in the range 0·001–3·0% sodium oxide are obtained in approx 40 min for routine industrial control.

G. R. N.

303. The Mass Spectrometer in Organic Chemical Analyses. R. C. Taylor, R. A. Brown, W. S. Young, and C. E. Headington. *Anal. Chem.*, 1948, **20**, 396.—Mass-spectrometer analyses of a number of mixtures, such as ethylene oxide, ethylene, and carbon dioxide; alkyliodides; aliphatic chlorides, ethers, and hydrocarbons; silicanes;

and water, ether, and alcohol are presented to show the utility of the instrument when used to analyse organic substances other than the usual hydrocarbons. The analysis of gas samples as small as 10^{-4} ml., and the qualitative identification of polymers and elastomers are discussed, and examples are given of organic elementary analysis. G. R. N.

304. Mass Spectra of some Organic Compounds. R. H. Roberts and S. E. J. Johnsen. *Anal. Chem.*, 1948, **20**, 690.—Mass spectra on fifty-three organic compounds, the majority being petroleum hydrocarbons, are presented as an aid to investigators in the field of analytical mass spectrometry. G.R.N.

305. Emission Spectroscopy in an Oil Laboratory. R. G. Russell. *Anal. Chem.*, 1948, **20**, 296.—The use of the spectrograph is different in the oil laboratory than in the metallurgical laboratory. It serves many functions not handled by any other analytical tool. It enables the operator quickly to analyse most types of materials with an accuracy in most cases equal to that of the best chemical methods. The analysis of used oils, oilfield brines, additives, minerals, corrosion products, steels, catalyst materials, and chemical residues are cited. G. R. N.

306. Estimation of Thiophene in Gasoline. H. C. McKee, L. K. Hundon, and J. R. Withrow. *Anal. Chem.*, 1948, **20**, 301.—A colorimetric method for the direct estimation of thiophene in gasoline, without interference from other sulphur compounds present, is described. The test is based on the blue colour produced by the endophenine reaction between thiophene and isatin in the presence of sulphuric acid. While extreme accuracy is not possible, the method is more rapid and easier than the conventional methods. Two variations are possible: an approximate method in which colours are matched by visual observation, and a more precise method using a spectrophotometer or other photoelectric colorimeter. G. R. N.

307. Determination of Unsaturation in Dehydrogenated Diethylbenzene. R. P. Marquardt and E. N. Luce. *Anal. Chem.*, 1948, **20**, 751.—A new method for the determination of the unsaturation in certain types of olefinic compounds is described, in which use is made of the well-known addition reactions of mercuric salts, especially mercuric acetate, to double bonds. The mercury in the addition compounds thus formed is titrated with standard ammonium-thiocyanate solution. This method has proved satisfactory as an assay procedure for styrene and styrene derivatives such as ethylvinyl and divinylbenzenes, vinyltoluene, and α-methylstyrene. G. R. N.

308. Determination of Water in Alkylation Sulphuric Acid. W. H. Goff, W. S. Palmer, and R. F. Huhndorff. *Anal. Chem.*, 1948, **20**, 344.—The Karl–Fischer method for determination of water was adapted. Pre-treatment of the sample with anhydrous ammonium chloride prevented decomposition of the Fischer reagent, and an electrometric technique permitted end-point detection. Accuracy on chemically pure acid solutions was sufficiently good to show average deviation from known water content of less than 0·1% absolute. Reproducibility on alkylation acid was good as was the recovery of known increments of water. The Fischer reagent used contained a ratio of 1 mol iodine to 2 mol sulphur dioxide to 8 mol pyridine and was dissolved in about an equal weight of methyl alcohol. G. R. N.

309. Patent. Gas Light & Coke Co. and A. R. Morcom. B.P. 612,142, 24.11.48. Process and apparatus for measuring the magnetic susceptibility of fluids. G. R. N.

Lubricants.

310. Experimental Methods for Studying the Mode of Action of Additives in Extreme-pressure Lubrication. R. Courtel. *Rev. Inst. franç. Pétrole*, 1948, **3**, 171–180, 198–204.—A detailed review is given of British and American publications on this subject that have appeared since 1940. Mention is also made of some recent French investigations, including work by the author on the study, by electron diffraction methods,

of the action of tricresylphosphate; the results obtained were, however, inconclusive. Other French workers have obtained promising results with thiocyanates, the activity of which is thought to be due to their reversible thermal dissociation, with formation of free S. The V.I. of the base oil is important and should be $\not< 85$. Twenty-eight references. V. B.

311. Oil Filters and Detergent Oils. Anon. *Petroleum*, Sept. 1948, **11**, 206.—The results of experimental work on filtration of detergent oils were recently presented at an S.A.E. National Fuels and Lubricants meeting by O. C. Bridgeman, E. W. Aldrice, and J. B. Roman.

The basic principle of the method for filter efficiency test was the continuous slow addition of concentrated sludge (centrifuge cake from stationary engines operated on non-additive mineral oil and free from the decomposition products of ethyl fluid) to the oil circulating through the filter under test.

Twenty filters were examined, consisting of paper, cotton, clay, cellulose, and mineral wool. The oils used were S.A.E. 30 grade—one being a straight mineral oil, and two others H.D. oils.

The paper filters showed approximately the same comparative efficiencies on the various test oils, although a few of them showed much lower efficiencies on one or both of the H.D. oils.

It was concluded that a compatability factor may exist between oil-type and filter type.

Experiments on additive adsorption by oil filters were concerned with: (1) direct adsorption of the additive material by the filtering medium; (2) removal by the filter of insoluble material containing adsorbed additive. Consideration was also given to thermal decomposition of the additive to form material insoluble in the oil which is removable on filtration.

A summary of detergent removal data after filtration of clean oil for 48 hr is given, from which it is deduced that there is a compatability factor in the filtering medium-detergent additive combination.

Ash determinations were used to evaluate the additive present.

Using clay filtering medium, with one exception, an increase in adsorption of detergent with increase of temperature was found.

The removal of detergent additive by adsorption on the solid particles in the used oil being additional to removal by the filter, it is first necessary to filter the oil sample. A method has been developed specifically for evaluation of the effective detergent contents of used oil.

Two sets of data were obtained on detergent removal by sludge, used oils for this work being obtained from eight different vehicles. Results presented show a drop in effective additive of 10–20% depending on the type of engine used for the tests. Data are also given showing the comparative removal of additive by direct adsorption and sludge retention.

Investigations are proposed to cover the effect of filters on oxidation and corrosion inhibitors and wear reducers. F. W. H. M.

312. Applicability of the Hydrodynamic Theory of Friction to Plain Bearings in the Region of Low Temperatures. M. P. Volarovich and O. V. Lazovskaya. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1948, 1607–1612.—Experiments were made with a bronze bearing 40 mm wide mounted on a steel shaft 50 mm dia; the bearing clearance was 0·05 mm. Tests were made with a bearing load of 7 kg/cm² at speeds of 32–48 r.p.m. for a number of motor oils in the temp range -39 to $+16°$ C, the visc of the oil at the test temp varying from 2140 to $2{\cdot}5 \times 10^6$ cp. The calc coeff of friction, f, is given by the expression

$$f = \frac{\pi\eta\omega}{\psi k} + 0{\cdot}55\left(\frac{d}{l}\right)^{1{\cdot}5}\psi$$

where η is the visc of the oil at the test temp; ω the angular velocity of rotation of the shaft; k the load on the bearing section in kg/cm²; d the dia of the shaft; l the length of the bearing; and ψ the relative clearance, *i.e.*, $\psi = \Delta/d$ where Δ is the diametrical clearance. Experimental results were in good agreement with calc values except at the very lowest temp where there was some divergence. It is concluded that for

bearings lubricated with motor oils the hydrodynamic theory of lubrication is applicable down to a temp of — 30° C. V. B.

313. Parameters for the Pumpability of Aero-engine Oils at Low Temperatures. S. L. Peisakhodina, R. N. Shneerova, and G. S. Tarmanyan. *Petroleum*, Aug. 1948, **11**, 179.—Consideration is given to pour points, viscosity indices, and measurements of viscosities at low temperatures in connexion with pumpability of aero-engine oils at low temperatures.

Using an apparatus consisting of oil conduits reproducing the lubrication system of an aero-engine, the authors compared the lowest temperatures at which a number of oils were considered pumpable with the standard pour point for those oils. The comparison shows that the pour point cannot be regarded as a criterion of pumpability at low temperatures. With minor exceptions the pumpability temperature is above the pour point, and the difference in temperature may be as much as 15° C.

In attempting to utilize viscosity characteristics, the "limiting viscosity" at which the oil is still pumpable in the system was sought. The viscosity varied at the minimum pumpability temperature between 330 and 460 stokes, corresponding to a temperature change of only 2–3° C. However, certain oils, whilst immobile in the viscometer, could be pumped at lower temperatures. Viscosity, therefore, has limitations in predicting pumpability at low temperatures.

Consideration of V.I. showed that in many cases it is not possible to use this as an indication of change of viscosity of oils at low temperatures.

It is concluded that pumpability temperatures must be determined in equipment reproducing fairly accurately operating conditions. F. W. H. M.

314. Synthetic Motor Lubricants. Anon. *Petroleum*, Aug. 1948, **11**, 183.—Tests using synthetic lubricants have been made on equipment belonging to the New York Power and Light Corporation, the results of which have been given by D. K. Wilson, Superintendent of Automobile Equipment, before an S.A.E. National Transportation Meeting in Chicago.

The two synthetic fluids tested were "Prestone" Nos. 200 and 300, motor oils of the "L.B." series of water-insoluble polyalkylene glycol derivatives. Their properties are listed.

In power-take-off air-compressors, engine cleanliness was impossible using "Regular" motor oil in spite of frequent filter changes and oil changes at 1000 engine-miles or less.

Use of detergent oils gave improved cleanliness when changed at 3000 engine-miles. In 1944 the vehicles were switched over to synthetic oil No. 300.

Previous experience showed that change in viscosity, ash, and acidity provided a good overall evaluation of the condition of synthetic oils. Figures are presented showing the variations in these characteristics during test for 20,123 engine-miles. The ash rose above the tentative limit of unsuitability after about 13,800 miles, but engine cleanliness appeared excellent throughout the test.

Tests on a Caterpillar Model 30 tractor and bulldozer used to require oil changes after 30 or 40 hr operation using "Regular" oils. This machine had to work in temperatures ranging from — 25 to 83° F. Starting troubles were the principal difficulties in cold weather.

Synthetic oil No. 300 has been used since 1944 with spectacular experience in starting, and the oil is drained at every 100 hr only.

Further experiences with power-take-off earth borers, winch-equipped line trucks, truck-tractors, and delivery trucks provide evidence of considerably extended drain periods using synthetic oils.

In the case of a truck tractor with a leak in the cooling system, a high iron-bearing ash was obtained.

The results show that increased mileages between sump changing are possible with synthetic motor oils, and a cleaner engine is also obtained. A single grade of oil covers a greater temperature range of usefulness. Care is needed if cooling-water leaks occur. F. W. H. M.

315. Chemical-physical Processing and Re-use of Used Emulsified Lubricants. E. Döring. *Erdöl u. Kohle*, 1948, **1**, 285–287.—Use of oil emulsions (containing approx 50% water) for lubrication does not effect an economy, as compared to the use of fresh

oil followed by re-refining after use, unless the oil in the spent emulsion is recovered. Methods of recovering oil from such water-in-oil emulsions are discussed, and a procedure described which consists in heating the spent emulsion to 100° C with 0·1–0·3% of a water-sol surface-active emulsion breaker and Na_2CO_3 (0·1% for every 10% of water present). The mixture is kept foaming (not boiling) for ½–2 hr till a withdrawn sample shows phase separation. It is then maintained at 85° C for 24–48 hr, after which the aqueous phase (containing most of the impurities) is run off. The supernatant oil is then ready for re-emulsification, without addition of further emulsifying agent. V. B.

316. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 608,854, 6.10.48. Modification of hydrocarbon materials more especially liquid lubricants.

Bataafsche Petroleum Mij. and W. David. B.P. 609,687, 20.10.48. Anti-corrosion oils.

Bataafsche Petroleum Mij. B.P. 609,688, 20.10.48. Regeneration of spent internal-combustion-engine lub. oils.

Bataafsche Petroleum Mij. B.P. 610,190, 27.10.48. Manufacture of mineral greases containing barium and/or strontium soaps.

Bataafsche Petroleum Mij. B.P. 610,344, 27.10.48. Process for improving lubricants.

J. C. Arnold (Standard Oil Development Co.). B.P. 612,965, 1.12.48. Additive for lubricants. G. R. N.

Bitumen, Asphalt, and Tar.

317. Structure of Bituminous Materials. I. Colloid-chemical basis of Bitumen Chemistry. K. Krenkler and R. Wagner. *Erdöl u. Kohle*, 1948, **1**, 280–285.—Contrary to the general view of bituminous materials as rigid micellar systems, it is suggested that bitumens form systems held together by association forces. The mol are considered to be spherical in shape, and this is confirmed by Staudinger's view that large spherical mol tend to powdery materials of low tensile strength and by the validity for solutions of bituminous materials of Einstein's visc equation. Bitumens are composed of various high-mol.-wt. hydrocarbons, and there is a smooth transition from the strongly associated micellar nucleus through a region of decreasing association affinity to the weakly oriented oil phase. The association effects in the mol increase on cooling with consequent increase in micellar size. On mixing with organic solvents the effect on mol association varies with the nature of the solvent, as is shown by the fact that bitumen solutions of equal concn in various solvents can have different visc. The partial precipitation of bitumens from solutions and the relationship between precipitation and mol. wt. of solvent are discussed in connexion with the solvation energy of the solvent. The behaviour of tar–bitumen mixtures is also considered on this basis. V. B.

318. Patents. Bataafsche Petroleum Mij. B.P. 610,086, 20.10.48. Production of asphaltic bitumens.

Louvroil–Montbard–Aulnoye. B.P. 609,624, 20.10.48. Plastic bituminous material.

Limmer & Trinidad Lake Asphalt Co. and D. C. Broome. B.P. 610,629, 3.11.48. Manufacture of bituminous materials. G. R. N.

Special Hydrocarbon Products.

319. Preparation and Properties of Methyl*cyclo*pentadiene. K. C. Edson, J. S. Powell, and E. L. Fisher. *Industr. Engng Chem.*, 1948, **40** (8), 1526–1528.—Pyrolysis of a petroleum naphtha by a series of fractional-distillation operations was used to obtain pure methyl*cyclo*pentadiene. Some physical constants of methyl*cyclo*pentadiene and of its dimer are given. Comparison is made between the dimerization and fulvene formation rates of methyl*cyclo*pentadiene and *cyclo*pentadiene. R. G. T.

320. Petroleum Solvents in the Paint Industry (1). W. S. Penn. *Petroleum*, Sept. 1948, **11**, 204.—Solvents derived from petroleum as used in the paint industry are discussed. The uses to which the various ranges of product are put are given. Their toxicity is considered in some detail.

Specification points relevant to white spirit are described. Analysis and testing procedures considered are flash point, solvent power, stability, and dilution, and the separation of solvent in the analysis of paints.

The sources, composition, and some properties of the types of solvents designated, benzine, distillate, petroleum ether, petrol, paraffin oil, and white spirit are discussed, and their more important properties are tabulated. F. W. H. M.

321. Switch-Oil Carbonization. A. Kobler. *Electr. Times*, 1948, **114**, 691–692.—Tests on an oil circuit-breaker filled with a paraffin-base oil (sp. gr. 0·86) were made at high (1500 amp 6·6 kV) and low (150 amp 6·6 kV) current densities with a mean energy liberation of 53·4 kW-sec. No significant difference between the quantity of solid particles produced in the two tests was observed, the amount being 43–47 p.p.m., of which copper was about 0·2%. The resistivity of the oil both before and after use was $> 10^{12}$ ohm cm. Conductivity measurements failed to show presence of oxidation products in the used oil. V. B.

Derived Chemical Products.

322. Chemical Propellants. (Stability of Mononitromethane). F. Bellinger, H. B. Friedman, W. H. Bauer, J. W. Eastes, and W. C. Bull. *Industr. Engng Chem.*, 1948, **40** (7), 1320–1323.—Mononitromethane is a powerful propellant, and, under certain conditions, can be detonated by impact, gunfire, high-pressure air, and high-velocity flow. Ability to detonate under these conditions seriously restricts its use as source of power for launching flying bombs. Prevention of detonation in reservoir and transfer lines requires specially designed equipment, since closed ends, constrictions, and other obstructions tend to cause detonation. By addition of gasoline (most practical) or methanol or amyl acetate, sensitivity of mononitromethane can be diminished. R. G. T.

323. Polyvinyl Alcohol as an Emulsifying Agent. G. F. Biehn and M. L. Ernsberger. *Industr. Engng Chem.*, 1948, **40** (8), 1449–1453.—Comparison is made between polyvinyl alcohols and other dispersing agents in the preparation of aqueous dispersions of mineral oils, vegetable oils, and other organic liquids. The most effective polyvinyl alcohols were high-viscosity products hydrolysed to 75–80%. A wide pH range is allowable in some cases, but the presence of salts has adverse effect on their dispersing ability. R. G. T.

324. Synthesis of 1 : 2 : 3-Trimethyl benzene, 1-Ethyl-3-Methylbenzene, and *m*-Xylene (by dehydrogenation of *cyclo*hexane intermediates). T. W. Reynolds, E. R. Ebersole, J. M. Lamberti, H. H. Chanan, and P. M. Ordin. *Industr. Engng Chem.*, 1948, **40** (9), 1751–1758.—Several methods of synthesis of 1 : 2 : 3-trimethyl benzene, 1-ethyl-3-methyl benzene, and *m*-xylene, applicable to the production of pure hydrocarbon in 10-gal quantities, are described. The three compounds were prepared by the dehydrogenation of suitable *cyclo*hexane intermediates. Physical constants and freezing or melting curves of the three aromatic products are included. R. G. T.

325. Production of Xylidines by High Pressure Hydrogenation (Quality and Performance Characteristics). J. F. Kune, Jr., W. C. Howell, Jr., and C. E. Starr, Jr. *Industr. Engng Chem.*, 1948, **40** (8), 1530–1538.—High-pressure hydrogenation of nitroxylenes was applied during the Second World War to produce xylidines for blending with aviation gasoline. The xylidines were found to be similar to other xylidines in imparting improved rich-mixture antiknock performance to the blends. Other properties discussed are: (1) poor colour stability necessitates treatment before use in blending; (2) freezing-point, water-solubility, and gum-stability characteristics are satisfactory; (3) reactivity with rubber and gasket materials, and toxicity are disadvantages. R. G. T.

326. Production of Xylidines by High Pressure Hydrogenation (Process Development). C. L. Brown, W. M. Smith, and W. G. Scharmann. *Industr. Engng Chem.*, 1948, **40** (8), 1538–1542. The mononitration of xylenes is described. The xylenes are mainly obtained as a by-product in the production of synthetic toluene from petroleum by the hydroforming process. High-pressure catalytic hydrogenation using a fixed-bed solid catalyst enabled quantitative xylidine yields to be obtained in the hydrogenation step. 85–90% of theoretical yields of finished-specification xylidines were obtained for use as blending agents in aviation gasolines. R. G. T.

327. Production of Xylidines by High Pressure Hydrogenation. (Pilot Plant.) A. Voorhies, Jr., W. M. Smith, and R. B. Mason. *Industr. Engng Chem.*, 1948, **40** (8), 1543–1548.—A pilot plant for the production of xylidines by high-pressure hydrogenation of mixed isomeric nitroxylenes is described. Operating data previously obtained on a laboratory scale were checked and found to be satisfactory for large-scale operation. Successful adaptation of the plant to the production of 8000 lb/day of xylidines was confirmed by actual operation on a scale twenty times larger than the semi-commercial scale. A description of the process and equipment involved, personnel requirements, types of data taken, and results are included. R. G. T.

328. Patents. Phillips Petroleum Co. B.P. 609,059, 6.10.48. Manufacture of alkyl pyridines.

Universal Oil Products Co. B.P. 610,397, 27.10.48. Production of carbonyl compounds.

J. C. Arnold (Standard Oil Development Co.). B.P. 610,752, 3.11.48. Production of ketones and aldehydes.

Phillips Petroleum Co. B.P. 610,987, 3.11.48. Production of 3-methyl pyridine.

Bataafsche Petroleum Mij. B.P. 611,919, 17.11.48. Reaction products of high-mol.-wt. unsaturates with inorganic acids or anhydrides.

Anglo-Iranian Oil Co., E. S. Narracott, and K. J. Rowland. B.P. 612,416, 24.11.48. Synthetic resin compositions. G. R. N.

Coal, Shale, and Peat.

329. Carbonizing Properties of Coking Coals. (Effect of Oxidation in Storage.) R. E. Brewer, D. A. Reynolds, W. A. Steiner, and R. D. Van Gilder. *Industr. Engng Chem.*, 1948, **40** (7), 1243–1254.—Effects of oxidation at room temperature and 99·3° C on eleven coking coals were determined by agglutinating tests, analysis, and carbonization tests at 800° C of both fresh and oxidized samples. Oxidation was found to decrease agglutinating value, C and H contents, and cal. val., and increase specific gravity and O_2 content. Oxidation affected carbonization products thus: decreased strength and fission of coke and yield of tar; increased apparent sp. gr. of coke and yield of $(NH)_2SO_4$, and irregular proportions of acid and residual pitch in tar. Most sensitive to oxidation were agglutinating value; tar yield and coke-strength simple factors to express relative rates of oxidation at two temperatures were established by correlation of charges in coal and coke properties of sample oxidized at these temperatures. An arbitrary measure of coke-strength index, defined as durability of coking power was computed at room temp for the durability of the sample at 99·3° C. The durabilities of the coals examined afforded a good indication of the known commercial-storage behaviour of the coals studied. An extensive bibliography is included. R. G. T.

330. Pyrolysis of Coal and Shale. (A Review.) C. H. Prien. *Industr. Engng Chem.*, 1948, **40** (9), 1649–1659.—The review is primarily concerned with the mechanism and practice of coal and shale pyrolysis, but includes a survey of raw materials, product and by-product characteristics and properties, carbonization equipment and improvements, and coke analysis and testing. The shale review includes papers on shale properties, shale-oil characteristics, retort design, and thermal extraction. An extensive bibliography includes references to gasification where these are not con-

cerned clearly with oxidation, hydrogenation, or other unit process. Recent high-pressure gasification, sub-bituminous and lignite gasification, and underground gasification have not been included to any great extent. R. G. T.

331. Patent. Standard Oil Development Co. and C. Arnold. B.P. 611,924, 17.11.48. Process for gas generation from solid carbonaceous material. G. R. N.

Miscellaneous Products.

332. Properties and Uses of Alkane Sulphonic Acids. W. A. Proell, C. E. Adams, and B. H. Shoemaker. *Industr. Engng Chem.*, 1948, **40** (6), 1129–1132.—A catalytic process for large-scale production of alkane sulphonic acids has enabled an investigation into physical and chemical properties to be made. Previous information on these acids is summarized. Corrosive action, solvent action, reaction with olefins, alkylation, and esterification are described with experimental details. Some derivatives and uses are given—surface-active agents; sours for tanning, laundering, and photography; selective solvents and solvents for special reactions, *e.g.*, chlorination, nitration, and oxidation; constituents of paint and varnish removers; soldering. The alkylation was mainly of aromatic compounds, *e.g.*, toluene and phenol. R. G. T.

333. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 609,287, 13.10.48. Vulcanizable composition.

Anglo-Iranian Oil Co., E. W. M. Fawcett, E. S. Narracott, and A. Millien. B.P. 609,307, 13.10.48. Production of plastic compositions.

Anglo-Iranian Oil Co., E. S. Narracott, A. Millien, and J. N. Haresnape. B.P. 610,020, 20.10.48. Production of plastic compositions.

Anglo-Iranian Oil Co., E. W. M. Fawcett, and E. S. Narracott. B.P. 610,037, 20.10.48. Production of polyvinyl-chloride compositions.

F. J. Cleveland (Socony-Vacuum Oil Co.). B.P. 610,056, 20.10.48. Method of making dithiophosphoric-acid esters of an alkyl-substituted phenol and mineral oils containing these compounds.

Anglo-Iranian Oil Co., E. W. M. Fawcett, A. Millien, and N. Mulhern. B.P. 611,010, 3.11.48. Production of polystyrene compositions.

Bataafsche Petroleum Mij., R. G. Aickin, L. W. L. Cole, and R. W. Noad. B.P. 611,152, 10.11.48. Antimosquito oils.

Monsanto Chemical Co. B.P. 611,210, 10.11.48. Preparation of detergents.

J. C. Arnold (Standard Oil Development Co.). B.P. 611,501, 10.11.48. Sulphurized oils.

J. C. Arnold (Standard Oil Development Co.). B.P. 611,642, 17.11.48. Manufacture of composite materials containing hydrocarbon co-polymers and bituminous materials.

Atlas Powder Co. B.P. 612,440, 24.11.48. Hydrocarbon wax compositions. G. R. N.

Engines and Automotive Equipment.

334. Explosions in Marine Crankcases. Anon. *Engineer*, 1948, **186**, 571.—Following on a crankcase explosion in a marine C.I. engine which caused a number of fatalities, the Ministry of Transport has issued a notice to marine-engine builders, shipowners, and ship-builders, pointing out that such explosions have been almost invariably due to overheating of an internal part and consequent ignition of lub.-oil mist with atmospheric air in the crankcase. Recommendations made to designers of engines of more than 500 b.h.p. include means of detection of overheating, explosion valves in crank-

case doors, prevention of passage of flame between crankcases of multiple-engine installations, and provision for injection of CO_2 gas into crankcases. A. C.

335. Heat Pumps Plus Oil Engines. Anon. *Oil Engine & Gas Turbine*, Oct. 1948, **16**, (186), 202.—The suggestion of combined working of oil engines and heat pumps was made by Prof. S. J. Davies and F. G. Watts in their paper entitled "Fuel and Power Economy with Special Reference to Heat Pumps" presented to the British Association for the Advancement of Science on September 13, 1948. The object of the authors is to urge the wider application of heat pumps in order to improve heat and power economy and the utilization of labour.

The authors point out the advantages of using oil engines in place of electrical power to drive compressors, and quote several combinations of oil engine and heat pump where part, or all, of the power of the engine is used for driving the heat pump. They show how the overall ratio of heat delivered to heat in the fuel can give a thermal efficiency of 155% for an oil engine whose total output is taken to drive the heat pump, as against 75% for an oil-fired boiler at full load. The authors show by other examples that a total overall efficiency is 228% in a particular installation is possible. C. D. B.

336. Patent. Texaco Development Corpn and A. H. Stevens. B.P. 611,620, 17.11.48. Operation of I.C. engines having airless injection of fuel. G. R. N.

MISCELLANEOUS.

337. Oil Reserves of the World—Their Distribution and Future. G. M. Lees. *J. Inst. Fuel*, 1948, **21**, 299.—An economic survey of world oil resources shows there is no likelihood of shortage for many years. The main reserves—U.S.A., Venezuela, Russia, Middle East, Mexico, and Rumania—are discussed with regard to availability, engineering effort required for production, and geographical distribution. The production of oil from coal, shale, or tar-sands is not considered likely to expand until the cost of natural oil rises considerably. R. G. T.

338. Petroleum Bacteriology. W. Schwartz and A. Müller. *Erdöl u. Kohle*, 1948, **1**, 232–240.—A comprehensive review dealing with the presence of bacteria in petroleum, the role of bacteria in the formation of petroleum, the breakdown of hydrocarbons by bacteria, and the technical significance of petroleum bacteriology. An extensive bibliography (119 references) is appended. V. B.

339. Some Thoughts on the Relationship between Coal and Oil. J. A. Oriel. *J. Inst. Fuel*, 1948, **21**, 246–247.—The relative merits of coal and oil are discussed with regard to the need for immediate fuel economy. Comparison is made of the two fuels in their various spheres of use—stationary power-stations, locomotives, furnace work, and domestic purposes. R. G. T.

340. Porous Metal Filter Elements. Anon. *Oil Engine & Gas Turbine*, Oct. 1948, **16** (186), 196.—Filters of sintered bronze for use in the oil-engine industry and their method of manufacture are described. The filter elements, composed of Porosint material, being highly porous have not the same mechanical properties of normal powder-metallurgy components, but nevertheless have mechanical properties which are, in some respects, superior to ceramic and other types of filters.

Performance data of different grades of sintered bronze are given in the form of graphs illustrating rates of flow characteristics against pressure drop. These filters have been successfully used in fuel injectors and for crankcase oil, fuel, petrol, and paraffin, but, in addition, may be used for the modification or adjustment of flow or the mixing of gases and liquids. C. D. B.

341. Patents. Bataafsche Petroleum Mij. B.P. 608,893, 6.10.48. Process for pasting halogen-containing polymerization products on surfaces.

Bataafsche Petroleum Mij. B.P. 609,166, 6.10.48. Removal of carbon monoxide from gases.

J. C. Arnold (Standard Oil Development Co.). B.P. 612,252–3, 24.11.48. Manufacture of stabilized synthetic lattices.

Bataafsche Petroleum Mij. B.P. 612,527, 24.11.48. Process for improving the crease resistance of textile material. G. R. N.

BOOKS RECEIVED.

British Chemicals and Their Manufacture. London: Association of British Chemica Manufacturers, 166 Piccadilly, W.1, 1949. Pp. 141.

This valuable guide to the British chemical-manufacturing industry gives up-to-date information on the manufacture of all types of chemicals and supersedes the 1946 edition. Its principal content is the classified list of products, from which it is a simple matter to trace a manufacturer in the directory of members of the association. A useful list of proprietary and trade names is also included, and not only gives the manufacturer's name but also the nature of the product.

A copy will be sent gratis to any inquirer writing on business paper or giving any other indication of his ability to put it to good use as a purchaser of chemicals.

German Intelligence Reports.

B.I.O.S.

1759. Montan and I.G. waxes. Pp. 72.
1787. Manufacture of diphenyl at I.G. Farbenindustrie A.G., Leverskusen. Pp. 6.
1794. Synthetic resins for surface coatings. Pp. 19.
1816. The "Sodingen" process for the recovery of ethylene from coke oven gas. Pp. 17.
Misc. 104. Dutch report on visit to I.G. Farben, Ludwigshafen and Oppau and Raschig Werke Mundesheim. Miscellaneous chemicals and instrumentation.

F.I.A.T.

1294. The thermal cracking of ethane. Oppau process. Pp. 21.

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Oilfield Exploration and Exploitation.

Geology.

342. Active-surface Catalysts in Formation of Petroleum. B. T. Brooks. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 2269–2286.—Any explanations of the composition of crude oils and the method of their formation must accept relatively low temperatures, usually not exceeding 140° F. There is a gap in our knowledge, between the contemporary sediments and the organic matter contained in them, and the heavy oils which are probably early petroleums. Both geological and chemical evidence are in agreement with a low-temperature history for all oils.

Barton's (1934) study of Gulf Coast oils showed that heavy asphaltic naphthenic oils changed with age and depth to lighter oils. Barton's data have been re-examined to include oils produced from newer fields and his results confirmed and extended. The variations in composition, however, for oils of the same age and depth are considerable. The conditions bringing about such changes are considered to be primarily the catalytic effect of the minerals in the formations with which the crude oil has been in contact. Since there is a wide variation in the catalytic effect of different minerals in producing chemical changes, a similar variation in the nature of crudes might be expected. Differences in the temperature gradients or bottom-hole temperatures also probably account for some of the variations in compositions of oils of the same age and similar depth in different fields. Active-surface minerals include most clays and sands containing clay, but such catalytic action has been noted with minerals other than clay. Purer limestones and dolomites have little catalytic action so that oils undergo little change after migrating into reservoir rocks. This may explain why heavy oils are often found in limestone reservoirs, although of relatively great age and at depths greater than overlying formations containing younger but lighter oils.

The chemical complexity of petroleums can also be explained by the catalytic effect of active-surface minerals. E. N. T.

343. Geology and Exploration for Oil in Salinas Valley, California. J. E. Kilkenny. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 2254–2268.—The stratigraphy and structure of the basin are reviewed. The writer believes that there were two important periods of faulting in the Salinas Valley and that the northern part of the Valley can be divided into three important fault blocks. The King City fault line separates the Central and Northeast blocks and has had an important structural influence during Tertiary time.

The history of exploration for oil in the Salinas Valley is also discussed.

E. N. T.

344. Southwest Colorado Strike Booms San Juan Basin. Anon. *Oil Gas J.*, 9.12.48, **47** (32), 137.—A well in the Dove Creek structure in southwest Colorado has had a promising gas-condensate producer. The estimated output on test was 15,000 million cu. ft with 200–500 b.d. The Mississippian was topped at 8143 ft. Perforations are at 5910–5934 ft opposite the upper part of the Paradox Salt (Pennsylvanian).

G. D. H.

345. Seven discoveries in Gulf of Mexico. L. S. McCaslin. *Oil Gas J.*, 30.9.48, **47** (22), 64.—Along a 220-mile stretch off the Louisiana coast from Breton Sound to Vermilion Parish three oil discoveries, three gas discoveries, and a distillate discovery have been

made. The Kerr–Gee find is 10 miles off Terrebonne Parish, and has three oil wells from a single platform. The Barnsdall *et al* well lies 11 miles from the mainland in Breton Sound, and has produced 2360 million cu. ft/day from 4130–4142 ft after being drilled to 10,600 ft. Superior's distillate well is 19 miles off Vermilion Parish. Production is from 9608–9618 ft. In the Main Pass area California has a 216-brl well, giving 26·2° oil from 5848–5857 ft. Off Grande Isle California has a 878-brl well at 8640–8665 ft. A 1,992,000-cu.-ft well has been completed by Magnolia 8 miles south of Coon Point. The same company has completed a further gas well at 11,351–11,358 ft, 12 miles offshore in the Eugene Isle area.

A table lists the offshore wells with their results, and some indication of the expenditure is given. G. D. H.

346. West Michigan Experiencing Big Exploratory Play. C. J. Deegan. *Oil Gas J.*, 2.12.48, **47** (31), 108.—The Stony Lake field in Oceana County, producing from the Traverse at 1600–1700 ft, opened an exploratory play in 1946. Kimball Lake in Newaygo County was opened in 1947, and produces from the Traverse at 2300 ft. The Pentwater field was discovered in 1948 and produces from the Dundee and Traverse. All are on the western side of the Michigan Basin.

Variable thicknesses of glacial drift render difficult the interpretation of geophysical work. Traverse production is usually from reefs, and Dundee production generally from secondary porosity due to dolomitization. There is a high percentage of dry holes among development wells. The location of producing structures along favourable trends is difficult. One technique uses lines of coreholes at 1–4-mile intervals crossing the trends. Suitable markers are 750–1000 ft deep. The trends are generally northwest–southeast. A map shows the trends, and the fields are listed with the daily rate in September 1948, the cumulative production, and the number of wells. G. D. H.

347. Fernvale and Viola Limestones of South-Central Oklahoma. S. A. Wingerd. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 2183–2253.—The Ordovician Fernvale (Richmond) and Viola (Trenton) formations of south-central Oklahoma are chiefly limestones with chert, dolomite, and detrital quartz sand, and are exposed in the Arbuckle and Wichita mountains.

Isopachous and lithologic characteristics indicate deposition in the north-west trending Arbuckle geosyncline having a broad platform in the Seminole area.

The Fernvale limestone contains abundant detrital quartz sand with crystallinity ranging from very coarse on the platform to medium in the basin. The Viola limestone is mainly dolomitic on the platform, cherty on the platform slope, and siliceous in the basin.

Lithologic characteristics of the Viola limestone indicate that it is divisible into four principle members, of which the uppermost and lowest wedge out northeastward from the basin to the platform.

Isopachous studies of the Fernvale and Viola limestones show that the orogenies which caused the folds and faults of the Arbuckle mountains, and adjacent subsurface anomalies, had no effect upon the original Fernvale–Viola basins during the deposition of these strata.

Very extensive stratigraphic correlation charts, tables, and isopachyte maps are presented in this paper. E. N. T.

348. New Developments at Benedum in West Texas. Anon. *Oil Gas J.*, 16.9.48, **47** (20), 155.—3 miles northwest of the discovery well a well is flowing 55° oil from the Pennsylvanian at 19–28 brl/hr with a gas–oil ratio of 2500. G. D. H.

349. Southwest Utah Gets an Oil Well. Anon. *Oil Gas J.*, 7.10.48, **47** (23), 293.—In Garfield County, southwest Utah, 1 Upper Valley Unit has swabbed 17° oil from fractured limestone at 8777–8791 ft in the Hermosa (Pennsylvanian). The well topped Dakota at 715 ft, Morrison at 837 ft, Chinle (Triassic) at 4293 ft, Kaibab (Permian) at 6040 ft. G. D. H.

350. Canada May Have Important Strike. Anon. *Oil Gas J.*, 23.9.48, **47** (21), 339.—A wildcat, 1 Redwater, some 40 miles north and a little east of Leduc, is reported to

have set pipe and to have 83 ft of pay. Earlier there had been rumours of a large flow of oil in a drillstem test of the Devonian at 3111–3131 ft.

12½ miles east and 1½ miles of Redwater a stratigraphic slim-hole test has been drilled to 2825 ft. G. D. H.

351. Lease Play in Northern Alberta Highlights Canadian Oil Activity. Anon. *Oil Gas J.*, 23.9.48, **47** (21), 154.—The area under reservation in Alberta has risen from 29 to 34 million acres due to the taking up of Crown-reservation oil and gas rights. A map shows some of the acreage taken up in northern Alberta, together with the ownership. A well at Redwater is said to have found oil in the Devonian at 3111–3131 ft.

In a slim-hole stratigraphic test programme, Amerada has completed ten holes in three months, the depths ranging from 2058 to 3425 ft. G. D. H.

352. Canada's Redwater Field Gets 5-mile NW Extension. Anon. *Oil Gas J.*, 25.11.48, **47** (30), 149.—4 Redwater, 5 miles northwest of the discovery, 1 Redwater, has discovered oil in a Devonian drillstem test. 1 Redwater had an open flow potential of 1700 b.d. of 35° oil, with 140 ft of pay. 2 Redwater, 5 miles north of the discovery, missed the reef. G. D. H.

353. Chile Wildcat May Prove to Be New Field Opener. Anon. *Oil Gas J.*, 7.10.48, **47** (23), 131.—1 San Sebastian, 50 miles south of Spring Hill, has been completed at about 7000 ft. 31° oil, probably of asphalt base, has been bailed from the same producing horizon as at Spring Hill. To date eight oil wells, five gas wells, and two dry holes have been completed at Spring Hill. G. D. H.

354. Pancoastal Plans Ruiz Area Test, Concentrate Drilling in Tucupido. Anon. *Oil Gas J.*, 7.10.48, **47** (23), 130.—At Tucupido (Venezuela) there are eight oil wells and two gas wells. One well has been temporarily abandoned. The output is about 6000 b.d.

Two producers are shut in at Pelayo.

A well may be drilled on the Ruiz area which is considered to be more favourable than the Tucupido area. G. D. H.

355. High Yield from Cretaceous Formation Boosts Output of Western Venezuela. D. H. Stormont. *Oil Gas J.*, 25.11.48, **47** (30), 64.—Cretaceous oil production in Western Venezuela is 168,000 b.d. from twenty-seven wells in three fields. At present nine wildcats are searching for Cretaceous oil. The wells are 8000–10,000 ft deep. La Paz was opened in 1944 and Mara in 1945. Cretaceous production has also been found at West Tarra. It has been reported that Cretaceous production has been found near Machiques, 50 miles southwest of La Paz, at about 11,550 ft.

La Paz is a northeast–southwest anticline with longitudinal and cross-faults. The northwest flank is steep. Production is from the Colon, La Luna, and Cogollo of the Cretaceous. In addition the Eocene and Guasare produce, and this oil was indicated by surface seepages.

Mara is a steep, faulted fold, and was discovered by geophysics, surface geology, and structure drilling. The limestone is topped at about 5500 ft. G. D. H.

356. New Oil Well in Turkey Reported with Good Flow. Anon. *Oil Gas J.*, 23.9.48, **47** (21), 157.—A new well in the Ramandagh Mountains has given 420 b.d. on test. G. D. H.

357. New Middle East Field Indicated in Report on Southern Iran Test. Anon. *Oil Gas J.*, 16.9.48, **47** (20), 68.—Basrah Petroleum Co's Zubair test 20 miles southwest of Basra is coring limestone at 7478 ft, and is reported to have had favourable oil shows shallower. A test is being drilled 20 miles northwest of Basra. G. D. H.

Geophysics and Geochemical Prospecting.

358. Concentration of Uranium in Black Muds. K. M. Strøm. *Nature*, 1948, **162**, 922.—The Cambrian black shales of the Oslo area contain 25–180 g/ton uranium.

Examination of black muds from Norwegian fjords shows that the uranium content, measured by an ether extraction method, varies from 13 to 60 g/ton, and there is a definite connexion between drainage from granite areas and uranium content. It is thought that precipitation starts by the formation of sulphide on the interface between the upper ventilated brackish water and the hydrogen-sulphide-containing waters of the deep. H. C. E.

359. International Union of Geodsy and Geophysics. J. Proudman. *Nature*, 1948, **162**, 744.—The Eighth General Assembly was held at Oslo during August 19–28, 1948. Discussions are here summarized under the following sections: Triangulation, Geodetic Levelling, Geodetic Astronomy, Gravimetry, The Geoid, Seismology, Meteorology, Terrestial Magnetism and Electricity, Physical Oceanography, Vulcanology, and Hydrology, including limnology, potamology, underground water, and snow and glaciers. H. C. E.

360. 1947 Geophysical Activity in the United States. E. A. Eckhardt. *Oil Gas J.*, 30.9.48, **47** (22), 70.—In 1947 $105 million was spent in the U.S.A. on geophysical work searching for oil. About $90 million was spent on seismic work. Nearly 75% of the work was in Texas, Louisiana, and Oklahoma; about 15% was in the Rocky Mountain area. The average number of gravity-meter parties operating was about 120, and about a quarter of the work was in the coastal areas of Texas and Lousiana; a further quarter was in the Rocky Mountain area.

Diagrams present data on the use of geophysical work in 1947, and the year by year activity. G. D. H.

Drilling.

361. Selective Acidizing. E. S. Villines. *World Oil*, Sept. 1948, **128** (5), 76.—Four methods of selective acidizing used in the Hugobon gas field are briefly described.

(1) Casing is run to the top of the bottom zone, and this zone is given a breakdown acid treatment. After further treatment, the next zone is treated by setting a plug in the casing and perforating opposite the zone.

(2) Casing is run through all zones, all zones perforated and zones treated by means of tubing and multiple packers straddling the pay zones, with perforated nipples between the packers.

(3) Another method uses a selective acidizing packer set at the desired position before acidizing.

(4) Casing is set at the top zone and the two top zones drilled and given breakdown treatment. Drilling is completed and the entire pay section treated and then given a clean-up shot. C. G. W.

362. Analysis of Present Day Oil Well Casing Cementing Practices. W. H. Griffin. *Petrol. Engr*, Nov. 1948, **20** (2), 117.—This is a discussion of the principles and practices of casing cementing. Problems encountered, the factors involved in successful cementing operations, and the methods and equipment used in present-day operations are dealt with. C. G. W.

363. Factors in Cementing Casing. G. C. Howard and J. B. Clark. *Oil Gas J.*, 11.11.48, **47** (28), 243.—The most important factors in successful cementing operations are: (1) prevention of channelling of the cement slurry through drilling mud; (2) removal of the mud filter cake from the well bore; (3) prevention of dehydration of cement slurry during placement.

Channelling of cement slurries through drilling mud is a problem of the efficiency of displacement of one fluid by another. An investigation of the flow properties of cement slurries was undertaken. Equations to determine the upper and lower critical velocities, *i.e.*, the limits of the region where either turbulent or laminar flow may occur are deduced. The studies indicated three regions of flow, namely, plug, laminar, and turbulent, with indeterminate regions between these states. A flow chart to determine upper and lower critical velocities of various cement slurries was prepared. To determine the efficiency of displacement, mud was circulated through an apparatus for 1 hr, then allowed to stand for 20 min. Cement slurries were then circulated at

varying flow rates until cement first showed with the displaced mud. In the plug-flow region approx 60% of circulatable mud was displaced while in the turbulent region more than 95% was displaced. Circulating water ahead of the cement in the turbulent region effected a 90% displacement and water proved as effective as other chemical washes.

The effect of mud properties on displacement was studied and indicated that the mud viscosity and mud weight are important. Decreasing the viscosity of the mud increases the displacement. Variation in mud weight gave erratic results with no definite trend.

It was found that a cement slurry in turbulent flow will not remove any appreciable amount of mud filter cake. The effect of holding casing off centre while cementing showed that only in turbulent flow would equal displacement efficiencies be obtained. With plug or laminar flow decreases in efficiency of 10–15% were observed.

Removal of mud filter cake may be accomplished by: (1) mechanical scratchers; (2) chemical washers; (3) fetting action. Of these (1) and (3) are most effective, (1) being preferable.

Loss of water to the formation during placing of cement may "freeze" the casing and prevent completion of the job. Use of a low-water-loss cement is desirable, and such a cement has been developed. Such cements are particularly useful where oil sands are encountered containing shaly impurities which swell on contact with water, reducing the permeability. References are appended. C. G. W.

364. Improvements in Cementing Practices. G. E. Cannon. *Oil Gas J.*, 11.11.48, **47** (28), 306.—Better evaluation of the properties of oil-well cements has resulted from measurement of their properties under well conditions.

Cementing jobs have been improved by the previous use of roto-wall cleaners with simultaneous circulation. By this method the number of precautionary squeeze-cement jobs has been reduced. Squeeze-cementing jobs, using a bentonite cement plus a sealing agent, have been used to seal porous formations in cases of lost circulation.

To avoid the danger of sidetracking the hole after an open-hole cementing job low-ultimate-strength cement has been developed. It is recommended that the regulations for cementing operations should be revised and standardized. The specified time "waiting for cement to set" before proceeding with operations might be reduced considerably, with an appreciable saving to the industry. C. G. W.

365. Advancement in Contract Drilling. A. J. Heiser. *Petrol. Engr*, Oct. 1948, **20** (1), 48.—A number of factors are responsible for the progressive trend in contract drilling. Improvements in equipment, techniques, and efficiency of personnel are major factors. Equipment is rigged for fast moves and unitized for simplicity. Close co-operation between contractors' operators and manufacturers is essential if the best equipment is to be made available. The need for fully trained personnel in all phases of contracting is emphasized. The increase in contracting costs and decline in revenues per ft makes accurate cost estimates essential. This necessitates accurate cost-accounting analysis of the types of wells and the risks involved. C. G. W.

366. Field Tests on Rejected Drill Pipe. A. W. Thompson and H. G. Texter. *Oil Gas J.*, 11.11.48, **47** (28), 252.—In the Permian basin of the West Texas field drill-pipe failures have been abnormally high. An independent investigation concluded that corrosion fatigue was the major cause. The solution to internal corrosion recommended was either the use of an internal coating, or chemical treatment of drilling fluid. Keeping the drill pipe in tension with enough drill collars to more than equal the weight on the bit was a major factor in reducing corrosion-fatigue failures.

This paper reports a test made to determine the importance of mill defects in drill pipe. A string of drill pipe was made up of mill rejects and used to drill the "salt string" drilled to case off the Permian. The beds range from 800 to 4500 ft in depth and are the principal cause of corrosion in the Permian basin. The major defect in each length was recorded as a measurement in feet and inches from the centre of the defect to the make-up shoulder of the box-tool joint. This enabled the relation of any failure to the defect to be deduced. In no case did any failure (of twenty-one failures) occur in a mill defect.

It is concluded that more attention should be paid to the care of drill pipe than to

surface defects. Scars from service use are probably more serious than mill defects. It is suggested that testing to a high hydrostatic pressure might be a better criterion of strength than measurement of surface defects. This was done on each string as a safety measure before undertaking the field test. C. G. W.

367. Stabilized Sea Drill. L. S. McCaslin. *Oil Gas J.*, 2.12.48, **47** (31), 58.—With this structure, the drilling equipment is supported on a floating-pile foundation. The piles are based on a large barge which when flooded sinks to the ocean floor. Stability is provided by two pontoons on either side of the structure, which are also submersible. The barge is 160 ft × 13 ft with a drilling slot 10 ft × 75 ft. Storage compartments for diesel fuel, fresh water and drilling water, and pumps for handling these and for flooding the barge are contained in the hull. The structure has two upper decks one holding the drilling engines, transmission mud-pumps, and two 400-brl mud-tanks. Above this are the draw-works, living quarters, etc. The effect of scour on the structure when sunk was determined by previous model studies and by sinking a stripped L.S.M. vessel near the proposed well location.

Advantages of the method are: (1) whole structure can be salvaged in case of abandonment; (2) very open structure at surface minimizes wave action; (3) changes in displacement with water level are negligible. C. G. W.

368. Corrosion Problems of Offshore Structures. E. Sterrett. *World Oil*, Sept. 1948, 128 (5), 84.—An offshore structure presents four zones of corrosion:

(1) The section buried in ooze and consolidated beds. This may be protected similarly to pipelines laid in salt marshes, etc.

(2) The section in contact with seawater. May be protected by insulation or by anodes, but protection must be maintained against buffetting and abrasion by sand.

(3) An area subject to air and salt water. Preventive methods available are (*a*) coatings of various types; (*b*) cladding of steel with resistant alloys; (*c*) cathodic protection, magnesium anodes are effective if the area ratio is about 1 : 500; (*d*) a strong concrete mix of 3–4 in thickness is very effective. C. G. W.

369. The S.P. Log: Theoretical Analysis and Principles of Interpretation. H. G. Doll. *Petrol. Tech.*, Sept. 1948, **11** (5); *A.I.M.M.E. Tech. Pub. No.* 2463, 1–40.—The S.P. log is a measure of the potential drop along the well caused by the ohmic effect in the mud, and its origin is discussed via the concept of a static S.P. The relationship between the static and logged S.P. is noted. The shape and amplitude of the S.P. log is influenced by the total e.m.f., the thickness of the bed, the resistivities of the beds and the mud, the diameter of the hole, and the amount of mud-filtrate penetration. Diagrams illustrate the various points.

The S.P. log, although indicating permeability, is not an absolute measure of that property or of porosity. Simple rules are given for determining more precisely the boundaries of permeable sections, especially for difficult cases such as those encountered in highly resistive beds. Methods are indicated whereby the presence of oil may be detected, or the amount of shale in sands may be estimated in favourable cases. G. D. H.

370. Bulk Handling Conserves Mud Materials. E. Sterrett. *World Oil*, Sept. 1948, 128 (5), 74.—Bulk handling uses hoppers accommodating 1000 sacks of mud additives and 300 sacks of gel material. The two bins for the two materials are built end to end on a skid. Materials are fed by a screw-type conveyor into a mixing chamber directly above the mud line. Proportioning of the materials is effected by adjusting the ratio of speeds of the screws. Feed to the screw is by gravity. Advantages of bulk handling are briefly discussed. C. G. W.

371. Control of Conventional and Lime-treated Muds in Southwest Texas. E. H. Lancaster and M. E. Mitchell. *Petrol Tech.*, Sept. 1948, **11** (5); *A.I.M.M.E. Tech. Pub. No.* 2457, 1–15.—A moderate alkaline–tannate–bentonite treatment has been found effective in mud conditioning for routine wells having a relatively short drilling time. The ultimate filtration rate was 10 cc or less, and the general terminal viscosities averaged 45 sec (Marsh). This viscosity was generally satisfactory. For wells requiring about thirty days or more drilling time, alkaline–tannate–lime–bentonite

treatment has been effective in maintaining satisfactory viscosities and filtration rates, with a substantial saving in chemical-treatment costs. The treatment has been advantageous with heavily weighted muds.

An analysis is given of several special mud problems, together with recommended treatment. These problems are lost circulation, blow-outs, sloughing shale, excessive chloride contamination, sulphate contamination, and the prevention and correction of cement contamination.

The economics of lime treatment of mud are briefly discussed. G. D. H.

372. Pneumatic Control in Drilling Mud Systems. J. E. Kastrop. *World Oil*, Sept. 1948, **128** (5), 71.—Steam-driven mud-pumps can now be remote-controlled. Compressed air may be applied to regulate the speed of both or either mud-pumps, or to by-pass the standpipe when adding joints to the drill string or during other operations. The system consists of: (1) a 4-in steam throttle valve; (2) main air control valve; (3) double-acting piston-actuated by-pass valve; (4) four-way diaphragm-operated spring-return valve; (5) pump-idling-speed control valve.

Operation is explained by reference to a schematic diagram of the system. The system may be adapted to electric- or I.C.-powered pumps. C. G. W.

373. Recording Device for Drilling Mud Control. F. Neurath. *Petrol. Engr*, Nov. 1948, **20** (2), 182.—Specific gravity, temperature, gas content, gel strength, pH value, viscosity, and sand content are automatically measured and remotely recorded. A discharge device empties mud into the measuring unit, and the above measurements are taken. The seven testing units are controlled by a selector switch driven by a synchronous motor. Time for measurements is 7 min at a mains frequency of 50 cycles. The recording unit can be used on all mains—110–240 V at 50 cycles. A system of alarms indicate "no-filling," no discharge, and gas. C. G. W.

374. Physical Properties of Laboratory Prepared Drilling Muds. H. B. Fisher and P. C. Carpenter. *Oil Gas J.*, 16.12.48, **47** (33), 76.—The effects of sodium carboxymethyl cellulose (Driscose) on prepared drilling muds are dealt with in some detail. Experimental detail and results are given. The outstanding property of Driscose is the lowered filtration rate. From 0·5 to 1·0 lb/brl reduces filtration rates from 30 to 70 cs (A.P.I.) to 10 cs. With high concentrations a limiting value of 3 cs is reached. Field experience shows better reductions in filtration rates than realized in laboratory tests. Electrolytes impair this water-loss-reducing capacity unless the mud is treated with caustic and quebracho. In some cases Driscose can be used to control viscosity and gel strengths, and in most cases improves thixotropic properties. On heating, viscosity and gel strength tend to decrease, but properties are appreciably stable.
C. G. W.

375. Plastic Resins Used With Oil-base Mud. O. O. Dale. *Petrol. Engr*, Nov. 1948, **20** (2), 168.—When using oil-base muds as a circulating medium difficulties are encountered in cementing with Portland cement. Cement does not bond well to an oil-wet surface, and it is necessary to use excessive amounts of Portland cement or to use mechanical scratchers or washing fluids. Thermosetting plastics of the phenol-formaldehyde types have been used for sealing off well fluids, and previous experience and laboratory tests indicated that plastics would provide an effective solution to such problems. When mixed with oil-base mud, a heavier and stronger mix is obtained by absorption of filler materials, oil forming a separate phase.

Plastics have been successfully tried for bottom plugging, cementing off parts and liner caps, and cementing blank liners between perforated intervals. Setting times with plastic resins are 1–2 hr. The plastics are applied either by dumping with a bailer or by pumping through tubing. The same tools are used in plastic cementing as in ordinary cementing. C. G. W.

376. Lost Circulation. E. W. Louden. *World Oil*, Sept. 1948, **128** (5), 85.—Lost circulation is the partial or complete loss to formation voids of the drilling fluid. Rate of loss depends on the formation permeability and the nature of the drilling fluid.

Lost circulation may be classified as: (1) high-pressure losses, where a high pressure is exerted against the formation (muds heavier than 90 lb/cu. ft); (2) low-pressure

losses, muds of normal weight; (3) cavernous losses. Curative methods for lost returns are :

(1) Use of plugging and bridging agents, *e.g.*, flax seed, cottonseed, fibrous material, mica, etc. These either plug the formation or form a lattice work on the face of the porous zone.

(2) Reduce the hydrostatic head by reducing the mud weight and/or the pump pressure. This method is not generally recommended, as quite a small reduction in mud weight may cause flow-back of formation fluids which if not controlled may result in a blow out.

(3) Cementing; use of quickset or gel cement is effective. Gel cementing is the only effective remedy for truly cavernous losses. The gel cement has a high angle of repose causing the cement to pile up in formation caverns. This results in more rapid plugging with less material than ordinary cement slurry, which tends to run into formation channels.

(4) In certain cases of low-pressure losses, drilling with water is used, cuttings being washed into the formation. High fluid velocities and vast supplies of water are necessary.

Where conditions to be encountered are known, preventive measures are of assistance. The casing programme should be designed to fit the conditions. Use of a mud of high gel strength will often secure returns and enable drilling to continue to a point where casing can conveniently be set.

The types of lost returns and their characteristics, materials, and methods for the cure and prevention and the limitations of such methods are discussed at some length. References are appended. C. G. W.

377. Tripod Derrick for Portable Servicing Unit. D. H. Stormont. *Oil Gas J.*, 9.12.48, **47** (32), 72.—The rig comprises a 94-ft mast which with draw-works and 165-h.p. diesel are mounted on a truck and trailer. Mud-pumps with their prime mover and other major items of equipment are loaded separately. The principal member of the derrick is in three telescoping sections, and additional support is provided by two helper legs of tool-jointed 6⅝-in drill pipe. The legs are pinned with lock sleeves and are tied together at the pipe rack and an adjustable telescoping brace. Additional bracing and guying of the helper legs gives a derrick which will handle 150,000 lb. The unit is used for heavy workovers, deepening jobs, and moderate drilling jobs. C. G. W.

378. Self-Propelled Service Derrick. H. David. *Oil Gas J.*, 2.12.48, **47** (31), 76.—The unit may be used with any of three derricks: two of 65 ft, hook-load capacities of 60,000 lb and 90,000 lb; and one of 90 ft, hook-load capacity 120,000 lb. The derricks are two-piece telescoping type of tubular construction and hydraulically erected. The hoist consists of a main drum and sand reel, the main drum having two friction clutches driven at different speeds so that a speed shift may be obtained without a gear change. Drilling controls are a combination of hydraulic and pneumatic systems located at a derrick leg. C. G. W.

379. Remote Control for Service Unit. G. Weber. *Oil Gas J.*, 18.11.48, **47** (29), 106.—The system uses compressed air for control of hoist and engine clutches, winch brake, gear shaft, and engine throttle. Brakes are automatically locked in case of air failure. Reduction of the time for cleaning jobs from 6 to 8 hr is anticipated. C. G. W.

380. Stresses Around a Deep Well. A. J. Miles and A. D. Topping. *Petrol. Tech.*, Nov. 1948, **11** (6), *A.I.M.M.E. Tech. Pub. No.* 2411, 1–6.—Assuming that rocks have a modulus of elasticity, a Poisson's ratio, and that the theory of elasticity applies, the stresses about a deep well have been investigated for various conditions of stress in the rocks prior to drilling the well. The studies indicate that the stress concentrations of shear, tension, and compression about the well are of a high order. If a unidirectional horizontal compressive stress existed before drilling, there will be stress concentration of both tension and compression at the same elevation and of such a magnitude as to render failure likely. There is also a shearing stress which may produce spalling. Internal pressure in the well will relieve the compression but not the tension, and will have little effect on the shear.

Plastic deformation of the rocks during geological time will lead to a diminution of the stress concentrations. G. D. H.

381. Well-head Stuffing Box for Armoured Electric Cable. D. B. Taliaferro and H. D. Hamontre. *Oil Gas J.*, 9.12.48, **47** (32), 105.—A stuffing-box designed for use in oil, gas, or water well heads under a pressure of 1000 p.s.i. is described. C. G. W.

382. Dry-hole Survey to Reduce Water Flooding Hazards. F. R. Cozzens. *Petrol. Engr*, Oct. 1948, **20** (1), 184.—The existence of unsuspected dry holes or abandonments may cause exploratory failures and may have a serious adverse effect on secondary recovery operations. It is suggested that in re-drilling any area, all dry holes and abandonments should, so far as possible, be located and mapped. Sources of information are: personal observation, property owners, lease holders, contractors, and drilling crews. Some of these wells may require plugging before undertaking operations. In any case, such wells, particularly if records are available, give valuable information on boundary margins, water zones, gas caps, formation faults, etc., thus eliminating a great deal of guesswork. Previous technical faults and bad practices can be avoided. Maps including abandonments are particularly useful in planning secondary recovery projects, since better control of flood energy is possible.
C. G. W.

Production.

383. Short Interval Acid Treating. J. H. Moore and J. W. Adams. *World Oil*, Sept. 1948, **128**, (5), 126.—Recent trends in acid treating have been towards the use of larger amounts of acid, increased injection pressures, and the treatment of thick producing zones in short intervals. Porosity and permeability of dolomite or limestone reservoirs varies considerably, and it is important to inject the acid into the less permeable zones. Methods of selectively treating short intervals have been either a two-pump procedure for placing and injecting, or by using packers. Difficulty in freeing packers, once set, has been a considerable drawback to the latter method. To overcome this difficulty the packer was made with an outer mandrel against the packing element and a smaller mandrel inside. When pulled, the outer mandrel is raised above the packer element allowing it to contract, before any pull is exerted on the element or lower parts of the assembly. With telescoping types additional aid was obtained by applying pump pressure between the packer mandrels to force them apart in unseating. A circulating head such that circulation may be employed throughout the entire system, or that fluid may pass through the packer and not above it, is added to give better control of fluid placement and circulation before acid treatment. Acidizing procedure is described. Flow rates from wells done in stages are doubled or tripled over the rates obtained in the original single-stage treatments. Other applications of the method are discussed. C. G. W.

384. Effect of Antifreeze Agents on the Formation of Hydrogen Sulphide Hydrate. D. C. Bond and N. B. Russell. *Petrol. Tech.*, Nov. 1948, **11** (6), *A.I.M.M.E. Tech. Pub. No.* 2450, 1–7.—Experimental work has shown that certain chemicals affect the formation of hydrogen sulphide hydrate. On a molar base the lowering of the maximum temperature at which the solid hydrate can exist in equilibrium with the given solution is sodium chloride 4·3°, calcium chloride 7·4°, methyl alcohol 2·5°, ethyl alcohol 2·9°, ethylene glycol 3·1°, diethylene glycol 5·1°, sucrose 3·8°, and dextrose 3·1°. For the same effect the costs are in the ratios sodium chloride 1, calcium chloride 2, ethyl alcohol 3, methyl alcohol 8, ethylene glycol 20, diethylene glycol 33.
G. D. H.

385. Surface Recording of Bottom-hole Pressures. W. C. Erwin. *Oil Gas J.*, 25.11.48, **47** (30), 116.—The equipment consists of a pressure-sensitive element combined with an electronic micrometer or measuring device. The element is made up into a unit with a packer, gun perforator, and tester and run to the test point. A sinker bar and electric connexion is run inside the operating string to the testing tool. When contact is made, the hydrostatic head is recorded at the surface. The well may then be shot, the instant of shooting is recorded, the packer set, the valve in the tester opened, and

a test started. A curve of formation pressure is then recorded at the surface. Drawing of the sinker bar opens a sampling chamber contained in the bar, permitting samples of the fluid entering the tester to be taken. Advantages of the method are described.
C. G. W.

386. **Squeeze Cementing.** W. E. Best. *World Oil*, Sept. 1948, **128**, (5), 132.—Squeeze cementing is defined as any cementing job where pressure is applied to drive the slurry to the desired position. Type of cement to be used depends on the bottom-hole temperature, depth, purpose of the job, and anticipated displacement time. 15–16 lb/gal (U.S.) is recommended for slurry weight. Squeeze pressures depend on a number of factors, and two formulæ are given for determining the maximum surface pressure. The recommended one is "Pressure to be applied is 40% of depth of the horizon + 1000 p.s.i." Hydrostatic head must be deducted from this. Present techniques employ retrievable cement retainers or bridging plugs set at a predetermined depth. The cement is pumped through the retainer or plug into the formation through perforations behind the casing. A clean hole is necessary for a good job, and if mud is in the hole water should be pumped ahead of the cement to wash the formation. An example of a squeeze job is given.
C. G. W.

387. **Condensate Production and Cycling. 19. Three Reservoirs Produced Simultaneously.** P. J. Jones. *World Oil*, Aug. 1948, **128** (4), 178.—A cycling programme is mapped out for producing three small reservoirs simultaneously.
C. G. W.

388. **Condensate Production and Cycling. 20.** P. J. Jones. *World Oil*, Sept. 1948, **128** (5), 156.—This concludes the series of articles. The compositions of production and cumulative liquid recovery for three reservoirs of the previous article are considered.
C. G. W.

389. **Core Analysis of Fractured Dolomite in the Permian Basin.** B. Atkinson and D. Johnston. *Petrol. Tech.*, Sept. 1948, **11** (5), *A.I.M.M.E. Tech. Pub. No.* 2432, 1–5.—A 36-ft diamond core from a fractured Ellenburger limestone reservoir has been carefully studied. The fractures were nearly vertical, and were 1 mm and less in width. Scattered solution vugs were up to 3 mm in diameter. There were signs of secondary dolomite deposition. Total connected porosity averaged 3·3%, and the matrix porosity 1·51%. Vugs and fractures ranged from zero to 5·59% porosity. 47·3% of the pore space was occupied by water. No relationship was noted between matrix porosity and total porosity.
G. D. H.

390. **Determination of Flow Coefficients for Positive Flow Beans.** J. E. Loeffler and F. H. Dotterweich. *Oil Gas J.*, 16.12.48, **47** (33), 83.—Bureau of Mines reports recommended choke nipples to measure rates of delivery of gas during back-pressure tests where it is impractical to use orifices. Difficulties have been encountered due to variations in the coefficients of the chokes. A number of interchangeable flow beans were tested in the laboratory by flowing gas through them in series, with a positive displacement meter and then in the field with an orifice meter. The displacement meter was checked by a critical flow prover. Flow and discharge coefficients for the beans were calculated and tabulated. These coefficients were then used in equations to give flow rates.

Accuracy by this method approached that of the conventional flow meter, but until flow beans are made to closely defined specifications it is necessary to calibrate each individually.
C. G. W.

391. **Steaming Flow Lines to Remove Paraffin.** Anon. *World Oil*, Aug. 1948, **128** (4), 165.—Accumulation of paraffin in flow-lines is a serious problem in many fields. Solvents, heating, and hydraulic methods have been used to combat the deposition. Recently, steam from a portable steam generator has been used with some success. The unit generates 1250 lb of steam/hr at 450° F, consuming 10 gal of kerosine/hr. Average costs indicate that half a mile of 2½-in flow-line can be cleared for about $18.
C. G. W.

392. Gas-Well Spacing. D. T. MacRoberts. *Oil Gas J.*, 16.12.48, **47** (33), 94.—In the case of gas reservoirs, one well will ultimately drain the reservoir, and hence spacing is more an economic than a physical problem. With water drive the formation of tongues of water by-passing parts of the reservoir creates a problem of spacing, but the more general problem is the economic one. Provided the problem is periodically re-examined to ensure that the basis has not changed, a general solution may be made assuming : (1) flow is viscous and isothermal ; (2) Boyles' law holds ; (3) all wells are operated under a back-pressure equal to a constant fraction of the closed pressure ; (4) optimum spacing is that spacing yielding maximum net income.

On these assumptions is based a mathematical solution which is also expressed graphically. It is noticeable that spacing is not greatly affected by considerable change in the variables. C. G. W.

393. Determination of Cycling Efficiencies in Cotton Valley Field Gas Reservoir. R. L. Hock. *Oil Gas J.*, 4.11.48, **47** (27), 63.—Extensive field tests have been made to check displacement efficiencies and dry gas patterns. Calculations are made of the present cycling efficiency and the predicted ultimate economic efficiency. Forecasts of future efficiencies were made by building a potentiometric model and calculating future production and injection rates to date. Actual and predicted results check satisfactorily. C. G. W.

394. Effect of Permeability Stratification on Cycling Operations. M. Muskat. *Petrol. Tech.*, Nov. 1948, **11** (6), *A.I.M.M.E. Tech. Pub. No.* 2494, 1–16.—A general theory is presented for the effect of permeability stratification on the efficiency of the gas-injection phase of cycling operations, and is applied to exponential, probability, and linear-permeability variations. It is deduced that the gross composite efficiency of the cycling operations will decrease as the variation in permeability increases. With exponential permeability variations, the wet-gas recoveries at initial dry-gas break-through decrease rapidly with increase in the ratio of maximum to minimum permeability. For a ratio of 10 the recovery is 45% for an areal sweep efficiency of 90% ; for a ratio of 1000 the recovery is 13%. If the abandonment limit is 10% gas the first case may give over 90% recovery, and the second about 50%.

The general trends of the curves for linear permeability distribution are similar to those for exponential distribution when total wet-gas recovery and through-flow are considered for similar stratification ratios.

The curves of total wet-gas recovery and total gas through-flow to different abandonment limits of wet-gas content against the variation parameter for probability permeability distribution have the same general features as for exponential permeability distribution. Theoretically there should be some dry-gas break-through immediately for all values of the variation in the probability permeability distribution, but dry-gas dilution will be slow, especially for low variation values, that the formations will resemble those with finite upper permeability limits. G. D. H.

395. Gravity Drainage Theory. W. T. Cardwell and R. L. Parsons. *Petrol. Tech.*, Nov. 1948, **11** (6), *A.I.M.M.E. Tech. Pub. No.* 2464, 1–13.—Equations are developed for gravity drainage, and these take account of the variation of permeability in the unsaturated region at the top of the draining column, but omit the capillary pressure gradients in this region. It is considered that for loose sands with permeabilities of the order of a darcy the latter approximation is admissible, and that the simple theory is adequate for any oil-bearing formations in which gravity drainage would be important.

The level of the saturated zone is computed for various times, and the saturation distribution is also calculated for different times. The shape of the computed distribution curve in the partially saturated zone is convex to the height axis, as compared with the concave form observed experimentally.

Application of the theory to oilfields will require further modifications to allow for convergence on wells, inclined drainage, and the simultaneous action of other recovery mechanisms. G. D. H.

396. Gun Perforating. 2. V. L. Forsyth. *World Oil*, Sept. 1948, **128** (5), 142.—This article deals with effects of gun perforating upon cement and formation. Surface

and subsurface tests were carried out. At the surface the test barrel was surrounded : (*a*) by concrete to represent dense limestone or sandstone ; (*b*) loose sand to represent unconsolidated formations. Subsurface tests were made on 5-in joints cemented into 7-in casing.

(1) *Effect upon neat cement.* Results indicate : (*a*) that cracking does not occur until strength is >245 p.s.i. tensile. Cement should not, however, be perforated when too "green" ; (*b*) compaction was considerable at strengths up to 245 p.s.i. tensile, and the area of compaction is greater with weaker cement ; (*c*) cement of given strength will shatter more readily and to a greater extent when backed by a soft formation than when backed by a hard formation.

(2) *Effect on formation.* In general, there was considerable cracking of concrete. For maximum formation cracking or penetration, bullets should be fired so that each receives the benefit of the preceding bullet.

Bentonite cement was more resistant to cracking than standard Portland cement at strengths greater than 300 p.s.i. tensile.

Results are tabulated, and a number of photographs of specimens shown.

C. G. W.

397. Mud Acid Increases Production in Tuscaloosa Sand. L. C. Power, Jr. *World Oil*, Aug. 1948, **128** (4), 168.—Producing zones in Tuscaloosa sands vary from 6000 to 11,000 ft. Porosities are high (up to 29%), permeabilities vary, but the average permeability is low. Mud acid–hydrochloric acid with some additives is used to increase permeabilities. High pressures are required to force the acid into the formation, operators usually using packers or retrievable retainers. The mud serves to disintegrate the filter cake and to increase permeability in the region of the well. This method of treatment has met with considerable success in these formations.

C. G. W.

398. Displacement of Oil from Porous Media by Water or Gas. H. J. Welge. *Petrol. Tech.*, Sept. 1948, **11** (5), *A.I.M.M.E. Tech. Pub. No.* 2433, 1–10.—Apparatus is described for studying the displacement of oil from cores by water or gas. The core is placed in a fritted glass plate. The results show that either water or gas displacement is efficient in removing oil from the limestone cores studied. After displacement only 10–20% of the pore volume retained oil. In some sandstone cores water was less efficient in displacement than gas, perhaps due to oil wetting the rock.

Alundum synthetic cores were employed to test the effects of interfacial tension and viscosity of the oil on displacement. It was found that large variations in interfacial tension of low-viscosity oil do not produce a large effect on the amount of residual oil, and a sevenfold increase in viscosity caused only a small decrease in displacement.

G. D. H.

399. The theory of Potentiometric Models. M. Muskat. *Petrol. Tech.*, Nov. 1948, **11** (6), *A.I.M.M.E. Tech. Pub. No.* 2490, 1–6.—The relationships based on the analogies between flow in porous media and electrical systems have been developed so as to take into account variable pay thickness, porosity, and permeability, and also the dependence of fluid density on pressure. In electrolytic models it is deduced that the electrolyte thickness must be made everywhere proportional to the millidarcy-feet of the formation. Previously the basis of the analogy has been an iso-vol-type model, but porosity does not enter directly into the construction of the model, although it is employed in converting voltage gradients into equivalent fluid travel times. Assumptions also are made that there is negligible cross-flow and that there is dynamic identity between the fluids on either side of the advancing interface of interest. G. D. H.

400. Factors Used in Allocation of Production among and within Pools. E. Kraus. *Oil Gas J.*, 11.11.48. **47** (28), 317.—A review is made of proration and allocation practices in the principal producing states. Factors used in proration schemes in operation are : (1) productivity ; (2) acreage ; (3) bottom-hole pressure ; (4) sand or pay thickness ; (5) reserves ; (6) market demand ; (7) depth ; (8) wells ; (9) potential ; (10) M.E.R.

All these factors are used to a greater or lesser extent, acreage being the most widely used, with or without other factors. (1), (8), and (9); whose use has been deprecated

by an A.P.I. committee, are still in use. (10) has been limited by the difficulty of determination.

The merits and demerits of some of these factors and their incidence are briefly summarized. References are appended. C. G. W.

401. Production by Solution in High Pressure Water. Anon. *World Oil*, Sept. 1948, **128** (5), 136.—Results of an investigation of the solubility of crude oil in water are given, and the application to oil production discussed. Initial experiments were carried out at atmospheric pressure. Later experiments were carried out in a test cell filled with clean silica sand, at a pressure of 1100 p.s.i. To reduce evaporation effects the apparatus was chilled with dry ice. The test cell was compared with a control cell at the same pressure. Water was passed through the test cell into a receiver. It was observed that a scum of oil accumulated in the receiver, that the discharge water was milky, and that ultra-violet light caused fluorescence, and also indicated suspended droplets in the discharge water. The lighter ends are preferentially dissolved, there being a marked reduction of A.P.I. gravity of the residue oil. Calculations based on the reductions in A.P.I. gravity in the test and control cells give a figure of 14% for the volume reduction due to solution of light ends. Similar calculations made with results from samples taken from wells in two water-flood projects indicate that from 10 to 15% or more of oil, left after mechanical displacement is complete, may be removed by solution in water at high pressures. The work done is not conclusive, and the need for truly quantitative investigation is stressed. C. G. W.

402. Calculation of Pumping Unit Engine Drives. E. Caraway. *Petrol. Engr*, Oct. 1948, **20** (1), 156.—It is commonly required to know the required pitch diameter of the engine sheaves. The following equation evaluates this:

$$\text{Dia eng. sheave} = \frac{\text{s.p.m.} \times \text{gear ratio} \times \text{unit sheave dia}}{\text{engine r.p.m.}}.$$

Either pitch dia or O.D. may be used, provided the same is chosen for both engine and unit. An equation for determining the ratio of sizes of unit and engine sheaves is:

$$\frac{\text{s.p.m.} \times \text{gear ratio}}{\text{engine r.p.m.}} = \text{relation of sheave sizes.}$$

In oilfield work "C" section V-belts are most common for pumping, "D" section for slow speed or heavy loads, "B" section are used with small P.D. sheaves or light loads. C. G. W.

403. Revaporization of Butane and Pentane from Sand. C. H. Weinaug and J. G. Cordell. *Petrol. Tech.*, Nov. 1948, **11** (6), *A.I.M.M.E. Tech. Pub. No.* 2467, 1–9.—Experimental studies have been made of retrograde condensation for methane–butane systems in an equilibrium cell with and without sand, and for a methane–pentane system in a cell with sand. In each case starting at a pressure of the order of 2000 p.s.i. production was taken from the top of the cell and analysed. In one instance the experiment was completed in 9 hr, in another in 72 hr. In the absence of sand the agreement between the experimental data and the equilibrium curve for methane–butane was closer at low pressures for the slow production than for the rapid production; the agreement was even better when sand was present, pointing to much better equilibrium in this case. The condition was similar for methane–pentane in a sand-packed cell, although in the absence of sand the equilibrium might have been expected to be less perfect than that for methane–butane with like production time. G. D. H.

404. Secondary Recovery in Arkansas. L. J. Jordan. *World Oil*, Sept. 1948, **128** (5), 121.—Co-operative and unitized secondary-recovery methods applied to four major oil pools in Arkansas have increased the rate of withdrawal and increased the recoverable oil by over 100 million brl. In all cases gas injection has in the later stages been augmented by water injection. Production data for the four pools are presented. Three other secondary-recovery projects are in the process of development in the area. C. G. W.

405. Volumetric and Viscosity Studies of Oil and Gas from a San Joaquin Valley Field. R. H. Olds, B. H. Sage, and W. N. Lacey. *Petrol. Tech.*, Sept. 1948, **11** (5), *A.I.M.M.E. Tech. Pub. No.* 2412, 1–16.—The volumetric behaviour of mixtures of black oil and natural gas, and condensate and natural gas from a San Joaquin Valley field, has been investigated. Measurements were made at temperatures of 100°, 190°, and 250° F at pressures ranging from 400 to 5000 p.s.i. The composition of the mixtures and their properties are tabulated. Graphs show the influence of pressure and temperature on the gas–oil ratio and formation volume of the bubble-point liquid.

Viscosity measurements were made in a rolling-ball apparatus, which is described. Four mixtures of black oil and natural gas were examined over the same range of conditions as for the volumetric studies. The viscosity of the liquid phase is tabulated.

The separation of bitumen from the mixtures at high pressures and high gas–oil ratios was studied. Negligible amounts of bitumen were precipitated below 3000 p.s.i., but about 24% of the bitumen separated at 5000 p.s.i. G. D. H.

406. Petroleum-Engineering Study of the Lake Creek Field, Montgomery County, Texas. H. B. Hill and F. A. Vogel. *U.S. Bur. Mines Rep. Invest.*, 4319, Nov. 1948, 65.—Lake Creek gas-condensate field was discovered in 1941 and is located about 37 miles N.W. of Houston, 11 miles N. of the Tomball, and 10 miles W. of the Conroe oilfields. The Wilcox group has been penetrated for 4810 ft and divided into nine principal producing zones.

This report is an engineering analysis of the reservoirs and includes estimates of initial volume of gas and recoverable hydrocarbon liquid. G. S.

Transport and Storage.

407. Crude-oil Lines Predominate in Foreign Building Programme. P. Reed. *Oil Gas J.*, 30.12.48, **47** (35), 162.—Tables show foreign crude-oil pipeline projects in mileage, diameter, status, and location, together with similar details for products and natural-gas pipelines.

Total projects comprise 12,000 miles and represent a quarter of world pipeline programmes. G. A. C.

408. Argentine Pipeline. F. H. Love. *Petrol. Engr*, Oct. 1948, **20** (1), 321.—This 1100-mile project from Comodoro Riverdovia to Buenos Aires will be complete early in 1949. Work began February 1948. So far as is compatible with minimum distance the line follows existing highways, bridges, etc., thus easing the problems of transport, river and road crossings, etc. Joints are electric welded by both rolling-weld and stove-pipe methods. An hydraulically operated line-up clamp is used for welding. Welds are inspected by magnetizing the area and sprinkling iron filings over the area. The pipe is cleaned, coated, and wrapped, and a holiday detector run to detect leaks in the wrapping. C. G. W.

409. Chilean Problems in Transporting Oil. G. M. Ruby. *Petrol. Engr*, Oct. 1948, **20** (1), 164.—The development of oil-bearing regions in the part of Chile south of the Straits of Megellan has raised serious transport problems. There are no natural harbours on this part of the Chilean coast, and considerable excavation and construction must be undertaken before tankers can be loaded. Further difficulties are created by the fact that even at summer soil temperatures the oil is jelly-like. The existence of a hot-water (100° F) sand may overcome this for short lines. For longer lines partial refining before piping will be necessary. C. G. W.

410. Environmental pH as a Factor in Control of Anaerobic Bacterial Corrosion. J. B. Hunter, H. F. McConomy, and R. F. Weston. *Oil Gas J.*, 11.11.48, **28** (47), 249.—The effect of increasing the environmental pH or alkalinity on the growth of sulphate-reducing bacteria has been studied, together with the pH level at which growth will re-occur after having once been arrested.

Laboratory investigations have shown that control of the alkalinity of the soil adjacent to a pipeline by electrical or chemical means in the field would be beneficial.

Two figures show the culture scheme for evaluating the effect of nutrient and falling pH on the development of sulphate-reducing bacteria. G. A. C.

411. Tapping Machine for Draining Pipeline. A. M. Hill. *Petrol. Engr*, Nov. 1948, **20** (2), 272.—It is frequently necessary to drain pipelines when replacing defective line. This is accomplished by drilling into the line through a tapping nipple and then connecting to a portable pumping unit. The original tapping machine was manually operated with ratchet lever and hand-wheel feed. Improvements on this are: (1) worm-gear drive operated mechanically or by hand; (2) telescopic boring bar and feed-screw with enough travel for all types of valve; (3) automatic feed which proportions the feed to the revs. of the hand crank.

Procedure is to weld a tapping nipple to the pipe. Install a gate valve on the nipple. Fit tapping machine to gate-valve flange by an adaptor. With valve in open position cut the pipe. Withdraw the cutting tool, close gate valve, and remove tapping machine. The tapping machine may be used also for installing or removing plugs in tapping nipples.

In evacuating pipelines it is advisable to tap the line at one or two high points to admit air. If this is not done, draining will be incomplete. C. G. W.

412. Interfacial Mixing Characteristics of Products in Products Pipelines. 2. S. S. Smith and R. K. Schulze. *Petrol. Engr*, Oct. 1948, **20** (1), 330.—After a number of unsuccessful criteria were applied, the Reynolds Number of 50/50 mixture determined from laboratory checks of viscosity against length was used to relate pilot lines to commercial lines.

Cross plots of available data were made, and to assist solution of mixture problems a chart of viscosities of 50/50 mixtures of common products is shown.

In handling cuts between products, extensive use has been made of the fact that the composition curve plotted as sp. gr. *vs.* through-put is a sine wave. Two methods of using this curve to determine suitable cut points for better protection of specification are described. Further test runs were made on Nos. 3–8 fuel oils to determine whether the available data are satisfactory in high-viscosity regions. The data applied provided satisfactory Reynolds Numbers are maintained. Details of operation practice are discussed. It is concluded: (1) that a continuous-stream gravitometer as an index of mixing is desirable in precision and dispatching and operation; (2) accurate spot time and quantity measurements are imperative to good handling.

It was found that the usual practice of spot sampling at given time intervals does not give accurate results. C. G. W.

413. Magnesium Anodes for Pipeline Protection. D. J. Walraven. *World Oil*, Sept. 1948, **128** (5), 182.—Corrosion is basically electrochemical in nature, anodic areas of metal being dissolved and maintaining a potential difference between anodic and cathodic areas.

Cathodic protection.—Applying an external current with the pipeline as a cathode has proved effective. Another method is the use of a "galvanic" anode such as magnesium. Such anodes are buried, surrounded by a low-resistance backfill mixed with water. A copper wire connects the anode and the structure to be protected.

Prepacked anodes.—The anode is ready packed in a suitable backfill material contained in a cloth bag. The bag is lowered, wet, into a prepared hole and the hole filled. The lead is then welded or brazed to the pipe. The number of anodes required depends on soil conditions and the size and condition of structure being protected, among other factors.

Advantages of the magnesium anode are: (1) more efficient than a concentrated ground bed; (2) no external source of power necessary; (3) maintenance and service of equipment eliminated; (4) does not affect other structures in the vicinity.

C. G. W.

414. Products Pipelines Technique. P. Reed. *Oil Gas J.*, 18.11.48, **47** (29), 86.—Operating techniques and equipment innovations in the Great Lakes Co.'s system are reviewed. Notable features are the adoption of "matching-line" operation; electric gauging of terminal tankage; stuffing-boxless pumps; medium-speed vertical diesels driving centrifugal pumps, and the development of a new type of tank-truck loading

machine. After installation of secondary booster stations to increase the capacity it was found that a new pipeline and primary stations would have effected considerable savings. Details of some of the new stations and equipment are described.
C. G. W.

415. New Wetting Method Cools Doped Pipe Safely, Quickly. P. Reed. *Oil Gas J.*, 9.12.48, **47** (32), 100.—A procedure is described whereby a wetting agent, alkyl aryl sulphonate, is added to the water used to cool coated pipelines to enable " cradling into the ditch " procedure to be carried out without damage to coating.
The method is successful with coated and wrapped pipes, the wetting agent allowing the sprayed water to cling to the entire surface to be cooled.
It has also been found that supporting the doped pipe above the bottom of the ditch with earth padding every 30 ft or so safeguards the pipe-protection materials during cradling. G. A. C.

416. Station Modernization. F. H. Love. *Petrol. Engr*, Nov. 1948, **20** (2), 282.—Mid-Continent Pipeline System has undertaken a modernization system, which with the installation of booster stations has increased the capacity of the system by 50%. Details of new construction work are given. C. G. W.

417. Scale Traps in Sour Crude Service. G. L. Crain. *World Oil*, Aug. 1948, **128** (4), 204.—Removal of scale by scraping led to damage to pumps, and scale traps have been designed to prevent scale from passing through pumps. The filter medium used consists of six to eight layers of jute bagging with 1-in layer of cotton waste. All heavy material and 60% of finely divided materials are separated within the trap. Details of the construction, and of modifications and improvements made in the light of practical experience, are described. C. G. W.

418. Suspended Material Carried in Oil Streams. J. E. Green, A. H. Hall, and J. R. Luttrell. *Oil Gas J.*, 11.11.48, **47** (28), 330.—Suspended solid material carried in crude oil comprises : (1) silica and quartz sand—either formation or wind-blown sand ; (2) silt ; (3) corrosion products—iron oxides and sulphides ; (4) metallic pieces—welding metal or cuttings ; (5) crystalline salts ; (6) carbon ; and (7) sulphur.
(1) and (3) comprise the greatest proportion by weight, the others being minor or negligible. Sizes of the particles range from colloidal to about 0·080 in ; larger aggregates of particles may occur. Methods adopted in sampling and extracting the solids are mentioned. Quantitative work was not possible. C. G. W.

419. Line Weld Checking with a Portable X-ray Unit. E. Sterrett. *World Oil*, Aug. 1948, **128** (4), 195.—The unit consists of a shell supported on two pairs of driver wheels set to span one-third of the pipe circumference. A third pair of wheels on a spring-loaded mounting centres the unit. A weld detector is carried ahead of the unit. The X-ray tube is shielded so that X-ray emanation occurs only in the narrow band necessary to cover the weld. Exposure is for 2½ min, and a wet film may be available within a few minutes. C. G. W.

420. Natural Gas Storage in Underground Pipe Sections. D. V. Meiller. *World Oil*, Sept. 1948, **128** (5), 171.—See Abstract No. 1052 (1948).

421. Cost-imating Vessels. W. L. Nelson. *Oil Gas J.*, 16.12.48, **47** (33), 113.—No. 9 in this series gives four tables relative to the cost of vessel or tower steel, installed costs of flanged connexions on vessels or towers, approximate weights of cylindrical shells and heads, and approximate cost of installed couplings. Prices are based on 1946 costs. G. A. C.

422. Cost-imating Special Vessels. W. L. Nelson. *Oil Gas J.*, 23.12.48, **47** (34), 81.—No. 10 in the series gives tables showing approximate costs of a vessel, cost of erection and fabrication, base costs of special alloys and clad steels and of linings.
The cost index for 1946 is taken as 100, and an example is worked out.
G. A. C.

423. Tanker Construction Programme at New Peak for Peacetime. B. Saurino. *Oil Gas J.*, 30.12.48, **47** (35), 150.—Tables show world tankship fleets by flag, actual and T2-SE-A1 equivalent as of January 1, 1949, selected age groups and distribution, analysis of ownership and ownership of U.S. privately owned fleet, U.S. Maritime Commission type war-built ships as of October 1948, employment of U.S. ships by areas, and tankships under construction. G. A. C.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

424. Oilburner Pulsations. Causes, Diagnosis and Cure of Rhythmic Noises. C. H. Burkhardt. *Fuel Oil & Oil Heat*, Dec. 1948, **7** (8), 45.—The term pulsation denotes a common type of service trouble which occurs in nearly all types of oil-fired boiler and burner installations, for differing periods. A pulsation is a rhythmic flame disturbance, and results from an upheaval of the basic conditions for the proper burning of fuel.

These basic conditions are: (1) that the fuel is properly prepared for combustion; (2) that it is mixed with the correct quantity of air; (3) that the mixture is burnt in suspension; (4) that products of combustion are rapidly removed from the flame.

There are two main types of pulsation, combustion and draft. The former results from improper fuel preparation, insufficient quantity of air, improper mixing of oil and air, and improper sized environment. All these except insufficient air quantity will result in low carbon dioxide readings and usually a little smoke. Insufficient air gives a high CO_2 reading and much smoke. Methods of eliminating the causes of combustion pulsation are discussed. Poor burner design is considered. It is seen that combustion pulsations are the effect of the movement of the whole body of the flame, predominantly in a horizontal direction, over a limited distance through the spray.

Draft pulsations are due to either insufficient or excess draft. These are always major pulsations. Methods of eliminating excess, and counteracting too little, draft are considered.

Light pulsations are caused by defective combustion conditions, intense or major pulsations are due to draft. D. K.

426. Low Pressure Burners. 2. Construction and Operation of the Williams Oil-O-Matic. F. Feigenbaum and J. E. Dignam. *Fuel Oil & Heat*, Dec. 1948, **7** (8), 51.—Williams Oil-O-Matic burner was a pioneer in the domestic low-pressure field. It began as a single-delivery burner, but early in its development it was changed to parallel delivery using the low-pressure cycle. The burner draws oil and air into its rotary compressor where they are mixed, then delivered to the sump for separation and from there led separately to the nozzle where remixing occurs. The compressor is not used for pumping oil from source of supply as in some other burners. The external design is conventional with electric drive from motor to other moving parts. The method of functioning is described in detail, and diagrams are included.

Adjustments of the burner do not give immediate response; time is necessary to see the ultimate reaction of the burner. To make the fire larger or smaller, the Threft meter adjustment, not the pressure adjustment, is used.

One gauge only is used in testing and adjusting; this is a pressure gauge with a range of 1–10 lb. Pressure is changed only to increase efficiency of breakdown at the nozzle and does not affect the fire.

Faults occurring in burners are considered. Lack of pressure can result in the inlet valve failing to open. Dirty muffler and worn rotor vanes result in pressure failure. Oil failures can be traced visually. A major trouble found in low-pressure burners is the flooding of the sump; this may be due to a leaky inlet valve. D. K.

427. Fluidizing Processes. Basic Observations from Laboratory Equipment. L. D. Parent, N. Yagol, and C. S. Steiner. *Chem. Engng Prog.*, 1947, **43** (8), 429–436.—The basic principles and characteristic features of the fluidizing process are described, and the results of investigations on a laboratory scale of the pressure drop attending the

upward passage of gases through beds of fluidized solids are reported. Variations in the behaviour of a bed of solids aerated in an upward direction are found to be due to size distribution; heat-transfer problems are discussed. J. G. H.

428. Heater Exchanger Maintenance. Anon. *Oil Gas J.*, 23.12.48. **47** (34), 64.—A symposium on heat-exchanger maintenance deals with rates of fouling and cleaning of unfired heat-exchanger equipment.

Man-hour requirements for cleaning outside of tube bundles is high, but justified by results. Successful removal of deposits with solvents depends on nature of deposits.

With regard to fouling rates, the use of chlorinated water results in high heat-transfer coefficiency; and pH control of circulating water leads to control of salt-scale formation. G. A. C.

429. Cleaning Tubular Heat Exchangers. P. F. Dougherty and C. H. Brooks. *Oil Gas J.*, 2.12.48, **47** (31), 83.—Various methods available for cleaning tubular heat-exchangers, with particular emphasis on the use of an emulsifying oil for "in place" cleaning, and on sand-blasting, are discussed.

Cleaning "in place" has many advantages, for example, down time for equipment is reduced, dismantling hazards and costs are avoided, and there is practically no loss of metal.

Methods available include chemical reaction and suspension of the fouling agent in the cleaning fluid.

Where the fouling material can be held in suspension in, or is completely soluble in the oil, an emulsifying oil can be used. The emulsifying oil was circulated at 150° F in a particular example of cleaning of the oil side of absorption oil-coolers.

Mechanical methods must be used where "in-place" processes are inadequate. These include lancing, rodding, and drilling and sand-blasting, which latter operation is successful with ordinary labour without special equipment.

The use of emulsifying oil as a cleaning agent for tubular equipment is covered by a U.S. patent application. G. A. C.

430. Mineral Wool Insulation for Processing Equipment. Anon. *Petrol. Engr*, Aug. 1948, **19** (12), 64.—Several cases are discussed to illustrate the technique and advantages of insulation of plant. These cases include: (1) a medium-sized asphalt tank, electrically heated; (2) high-temperature flue-gas duct; (3) insulation of butane storage tanks to operate at 45–50° F and 20–25 p.s.i. pressure; and (4) valves, flanges, and fittings. G. K. A.

431. Power Absorption in Mixers: Correlation with Equipment Dimensions and Fluid Properties. R. B. Olney and G. J. Carlson. *Chem. Engng Prog.*, 1947, **43** (9), 473–480.—Agitator power data are reported for single-phase liquids and two-phase liquid mixtures using disperser and spiral turbine impellers, with impeller speed, and properties and proportions of the liquids as the only variables. Data so obtained are correlated with power studies reported by others for flat paddles, turbines, propellers, and dispensers, using a power-function–Reynolds Number relation. In this manner fair agreement with single-phase power studies has been obtained by using average densities and viscosities for the mixtures. Basic data are presented for the construction of standard-design impellers. J. G. H.

432. Power for Pump Drives. Refiners' Notebook No. 216. W. L. Nelson. *Oil Gas J.*, 30.9.48, **47** (22), 103.—A graph is given which may be used to determine necessary horse-power to drive a pump when pressure difference (discharge minus suction) and delivery in g.p.m. are known. It is based on a pump efficiency of 72% and a transmission mechanism efficiency of 90%. Horse-power may also be calculated from the formula

$$\text{h.p.} = \frac{Wh}{33{,}000\ E_p E_t} = \frac{\Delta PG}{1713\ E_p E_t} = \frac{Ghd}{3957\ E_p E_t}$$

where W = lb liquid; h = feet of liquid; ΔP = pressure difference, p.s.i.; G = g.p.m.; d = sp. gr.; E_p = pump efficiency; E_t = transmission efficiency.

W. M. H.

433. New Process Developed to Produce O_2 from Air for Petrochemical, Other Operations. B. H. Van Dyke. *Oil Gas J.*, 9. 12.48, **47** (32), 112.—A system for production of oxygen from air is described. Air is dehumidified and freed from dust and finally cooled to approximately minus 310° F; water vapour, carbon dioxide, and other impurities are frozen out, liquid nitrogen from the process being used as cooling medium.

Distillation at atmospheric pressure combined with nitrogen liquefaction and refrigeration produces oxygen with over 99·5% purity, and 95% recovery.

Oxygen can be obtained at any purity, and the plant can produce 95 and 99·5% purity oxygen simultaneously. G. A. C.

434. Cost-imating Petrochemical and Small Tanks. W. L. Nelson. *Oil Gas J.*, 25.11.48, **47** (30), 133.—No. 6 in this series gives six tables showing costs for various capacities refinery rundown tanks (10,000–200,000 gal), bolted oilfield stock tanks (65–1000 brl), small flat-head and disced-head chemical tanks (200–2400 gal), alloy and special-steel cone-roof chemical tanks (25,000–250,000 gal), Redwood oilfield stock tanks (250–625 brl), and wood chemical tanks (500–2000 board-ft). Costs for 1946 are the basis. G. A. C.

435. Mechanism of Countercurrent Gas–Liquid Flow through Packed Towers. F. A. Zenz. *Chem. Engng. Prog.*, 1947, **43** (8), 415–428.—A theory is developed clarifying the characteristics of countercurrent flow through packed towers based on analogy to the flow of vapours through valves and orifices. The " flooding point " definition so obtained provides data which correlate as well or better than " visual " determinations, and enable a correlation of pressure drops at this flooding point to be obtained. In the same manner, an equation is evolved for calculating the pressure drop at various flow rates, and the necessity for additional investigation of the correlation of pressure-drop data in the liquid-continuous range is emphasized. J. G. H.

436. Condensation of Vapours on Outside of Finned Tubes. K. O. Beatty and D. L. Katz. *Chem. Engng Prog.*, 1948, **44** (1), 55–70.—The application of externally finned tubes as a means of increasing rate of heat transfer in surface condensers is outlined, and the methods of obtaining condensing-film coefficients for methyl chloride, sulphur dioxide, Freon 22, propane, *n*-butane, and *n*-pentane on the outside of a horizontal, integral, spiral-finned tube with sixteen fins per inch with fins ¼ in high are described.

Measurements using Freon 22 were made on a series of special tubes with varying fin heights and metal conductivities, and film coefficients determined by a modification of the Wilson method, which is described in some detail.

Correlation of film-condensing coefficients within reasonable limits is obtained by treating the finned tube as vertical surfaces, corresponding to the fins, and a horizontal tube surface. J. G. H.

437. Pressure Drop Across Tube Banks: Critical Comparison of Available Data and of Proposed Methods of Correlation. D. F. Boucher and C. E. Lapple. *Chem. Engng Prog.*, 1948, **44** (2), 117–134.—The desirability of correlation of the large body of data on the estimation of pressure drop across tube banks is emphasized. Limiting consideration to plain tubes and utilizing all data now available, a summary and comparison of methods of correlation is presented, and the effect of recording variables discussed. A fundamental correlation of pressure-drop data based on essentially isothermal and isobasic data allows for the analysis of non-isothermal and non-isobasic data in terms of the basic relationship. J. G. H.

438. Pressure Drop through Packed Tubes. Part II. Effect of Surface Roughness. M. Leva and M. Grummer. *Chem. Engng Prog.*, 1947, **43** (11), 633–638.—In a previous paper an equation for the pressure drop of gases through packed columns was derived which is valid for smooth-surfaced packing. The effect of surface roughness of the packing particles upon the pressure drop is investigated and indicates that, other conditions being the same, the pressure drop through very rough particles is more than twice that through smooth packings. A comparison of the effect of voids in the bed upon the pressure drop with that of particle roughness, reveals that voids in the bed influence the pressure drop to a much greater extent than does the surface rough-

ness. A further comparison is made of the effect of roughness of the packing particles upon the pressure drop, with the effect of pipe-surface roughness upon the pressure drop for flow through empty conduits. J. G. H.

439. Reaction Rate, Heat Transfer and Temperature Distribution in Fixed-Bed Catalytic Converters. Solution by Electrical Network. R. H. Wilhelm, W. C. Johnson, R. Wynkoop, and D. W. Collier. *Chem. Engng Prog.*, 1948, **44** (2), 105–116.—A theoretical background is provided for experimental studies of flow-system catalytic reactions in those cases where thermal problems are of importance. Existing literature is reviewed, and fundamental heat-balance equations presented, together with a discussion of the kinetics and thermodynamics of the reaction, solid-gas, convection heat, and mass-transfer coefficients, and the thermal conductivity of granular media. A semi-empirical correlation for estimating the conductivity of granular media is presented.

The application of an electrical network, depending upon the mathematical analogy between Fourier's law of heat conduction and Ohm's law of electrical conduction, to the analysis of thermal problems in catalytic reactions is outlined; advantages are enumerated, and the construction of a particular network is described in detail.

J. G. H.

440. pH Control Through Use of a Sulphur Burner. R. C. Ulmer and J. F. Churchill. *Oil Gas J.*, 25.11.48, **47** (30), 111.—The problems involved in water-cooling equipment include scale and deposit formation, corrosion, algæ and slime, and delignification.

Scale and deposit formation is due to precipitation of calcium carbonate, and iron oxide, from heated hard waters.

Corrosion is caused by dissolved oxygen and carbon dioxide present in most waters. Algæ is a plant growth, and delignification is an apparent rotting of wood due to extraction of the lignin and cellulose products.

Shortcomings of previous corrective methods has led to use of an anti-precipitating agent in conjunction with a sulphur burner to control pH of the water.

Sulphur dioxide passes from the burner to an absorption tower through which the water passes at the rate of 100 g.p.m. The sulphurous acid formed reacts with sodium or calcium bicarbonate present to form the sulphite.

Delignification is prevented by adjustment of the pH of the water to 8·0 or 8·5, the optimum figure also for scale prevention.

Costs are less than when using sulphuric acid.

Typical operating data for two plants are given. G. A. C.

Distillation.

441. Distillation of Phenolic Brines. M. J. P. Bogart and A. S. Brunges. *Chem. Engng Prog.*, 1948, **44** (2), 95–104.—The separation of phenol from aqueous solutions of various concentrations presents technical difficulties which are accentuated by the toxic effects of the smallest concentration which may escape in waste disposal. The removal of phenol from weak aqueous solutions has been commercially effected by distillation in the presence of salt at atmospheric and higher pressures, the salt performing a function equivalent to that of the selective solvent in extractive distillation. A flow sheet is presented, and operating details are discussed. J. G. H.

442. Evaluation of Azeotropic Entrainers. L. Berg and J. M. Harrison. *Chem. Engng Prog.*, 1947, **43** (9), 487–496.—The functions of azeotropic distillation in the separation of mixtures not separable by straight rectification, and for the resolution of mixtures of close-boiling constituents which can be separated by rectification only with difficulty, are outlined. In the separation of a standard mixture of methyl*cyclo*hexane–toluene employing the homologous series of lower aliphatic alcohols as entrainers, the percentage of toluene of a given purity at various reflux rates is correlated with the amount of material necessary to be handled, heat requirements and the nature of the entrainer. The effectiveness of the entrainer in relation to purity of product, reflux ratio and yield is discussed, together with variations occasioned by the isomeric nature of the entrainer itself. J. G. H.

443. Cost-imating Fractionating Towers. W. L. Nelson. *Oil Gas J.*, 30.12.48, **47** (35), 277.—No. 11 in the series gives information additional to that in No. 10 to enable estimation of costs of fractionating towers to be computed.

Tables give approximate fractionating-tower data, cost of bubble trays and of fractionator items. G. A. C.

Absorption and Adsorption.

444. 85 Million Cubic Feet of Casing-head gas Daily Utilized by Shell in Two Newly Completed Plants. D. M. Duff. *Oil Gas J.*, 21.10.48, **47** (25), 90.—Two major projects of the Shell Oil Co. Inc. for processing casinghead gas, in the West Texas area, are described. One, serving the TXL and Wheeler fields, has a daily capacity of 45 million cu. ft.; the second, with recent expansions, processes 60 million cu. ft. in the Yoakum County at the Wasson Plant.

The TXL and Wheeler plant is connected to 175 wells in the area, is operating at 5 million cu. ft. above design capacity to produce 65,000 gal of 26 lb R.V.P. natural gasoline, 40,000 gal mixed butanes, and 39,000 gal pure butane. About 32 million cu. ft. daily of residue gas go to the El Paso Natural, and the remainder is used as fuel for operations.

A feature of the plant is design for minimum consumption of scarce available water.

The Wasson plant was extended by doubling compressor horse-power and adding processing and other facilities as required. Then equipment for propane recovery was installed. Two plants operate in this field, and are connected to 1500 wells, with a total capacity of about 100 million cu. ft. daily. About 10 million cu. ft. of residue gas goes to a carbon-black plant, 15 million cu. ft. to a power plant; the remainder is used for plant fuel, and the excess flared. About 175,000 gal of liquid products are now obtained daily from the two Wasson plants. G. A. C.

445. Ethylene Purification by Absorption Process. L. Kniel and W. H. Slager. *Chem. Engng Prog.*, 1947, **43** (7), 335–342.—A description is given of the Monsanto Chemical Company's ethylene plant at Texas City. Cracking-unit effluent after compression is passed through a fractionating absorber, the operation of which is described. Advantages of the absorptive recovering unit as a means of processing varied charging stocks are outlined, and the necessary modifications for this purpose described, together with special refrigeration requirements. J. G. H.

Cracking.

446. Pilot Plant Developments at Baton Rouge. E. V. Murphree. *Petrol. Engr*, Sept. 1948, **19** (13), 86.—After considering the great expansion of research laboratories, the development is considered of the fluid-catalytic-cracking process and the achievements that have been gained.

The hydrocarbon-synthesis process using natural gas is considered, and the advantages gained by the application to this process of the fluid-catalyst technique are considered. This technique can also be advantageously applied to the shale-retorting process. G. K. A.

447. Thermofor Pyrolytic Cracking Process. S. C. Eastwood and A. E. Potas. *Petrol. Engr*, Aug. 1948, **19** (12), 43.—A new process—the Thermofor Pyrolytic Cracking Process—has been developed to produce ethylene and aromatics by high-temperature low-pressure cracking. The system consists of two parts, a heater and a reactor.

In the heater, non-catalytic refractory pebbles 0·2–0·4 in dia are preheated to the desired temperature by direct combustion of the fuel gas in the pebble bed. The heated pebbles gravity flow into the reactor, where they preheat and crack the hydrocarbon feed in a counter-current system. The cooled pebbles are recycled to the heater by a bucket elevator. Any carbon deposition is burnt off the pebbles in the heater.

Ethylene yields range from 28% by weight of charge for paraffinic stock to 11·7% for naphthenic stock. Total aromatics yield is about 20%. G. K. A.

Chemical and Physical Refining.

448. Phase Relationships for Petroleum Fractions. W. C. Edmister and D. H. Pollock.

Chem. Engng Prog., 1948, **44** (12), 905.—Phase conditions of petroleum fractions are frequently desired in connexion with process design of petroleum-refining equipment.

From a large accumulation of data it is now possible to predict the equilibrium flash-vaporization (E.F.V.) curves of petroleum fractions at various pressures. This method consists in: (*a*) a three-way correlation between A.S.T.M. true boiling point and atmospheric E.F.V. distillation curves; (*b*) a critical point correlation; and (*c*) a correlation for the effect of pressure on E.F.V. curves. O. M.

449. Processing Sour Crude at Globe Oil & Refining Company's Lemont, Ill., Refinery. R. B. Pierce, W. F. Krausel, and J. M. Lawson. *Oil Gas J.*, 30.9.48, **47** (22), 96–97.—Globe Oil's refinery operation for several years has averaged 25–50% sour crude from West Texas, Wyoming, Kansas, Gulf Coast, and Illinois. Sour crude is segregated from sweet in floating-roof tanks, and is processed on a 9000 b.d. topping unit and a 22,000 b.d. combination unit. The topping unit is operated on 100% sour crude, except for 24 hr before an inspection shutdown.

Cracked gasoline is sweetened on the Linde copper-treating unit after extraction of 60% of mercaptans by a regenerable caustic scrubber.

The C3–C4 poly feed is put through a Girbotol amine unit to remove hydrogen sulphide and a caustic solution to remove mercaptans.

Measures to protect plant against corrosion are discussed. W. M. H.

Special Processes.

450. Complete Gas Utilization is Stressed by McCarthy's New Petrochemical Plant. L. S. McCaslin. *Oil Gas J.*, 23.12.48, **47** (34), 72.—A review is given of the Winnie, Texas, unit of the petrochemical development by McCarthy Chemical Company.

Acetaldehyde and methanol are produced from residue gas, of which 100,000 million cu. ft/day are available.

Features include structures to withstand 125-m.p.h. gales, plastic-lined tanks for formaldehyde, and power generation using as fuel gas which has passed through the plant. G. A. C.

451. Thermofor Pyrolytic Cracking. S. C. Eastwood and A. E. Potas. *Refiner*, Sept. 1948, **27** (901), 468.—This new process has been developed by Socony-Vacuum and is a method of producing ethylene by cracking a wide range of charge stocks from ethane to crudes. The system comprises two main elements, a reactor and a heater, the latter being directly gas fired to preheat pebbles to the desired temperature of about 1500° F: the pebbles are of refractory material and about 0·3 in diameter. The hot pebbles are passed into the reactor counter-currently to the hydrocarbon feed. Extremely high rates of heat transfer, of the order of 15,000 B.Th.U./hr/° F/cu. ft. of pebbles, are attained in this type of reactor. The cracking temperature is controlled by the temperature of the pebbles entering the reactor, and the contact time by the vapour rate and the bed depth. The results of pilot-plant operation are given both for cracking light hydrocarbon and for various crudes; ethane gives the highest yield of ethylene while aromatic- and naphthenic-type liquid charges give the lowest. The process is very flexible. H. A. C.

Metering and Control.

452. Automatic Control of Fractionating Towers. V. V. St. L. Tivy. *Oil Gas J.*, 25.11.48, **47** (30), 85.—An outline is given of the reasoned application of automatic controllers to fractionating columns.

The design of processing equipment should be carried on concurrently with the design of the automatic control system.

For maximum column efficiency, the feed, velocity, heat input, reflux ratio, and withdrawal rates must be maintained at a steady figure. Operation is materially affected by four variables, *viz.*, pressure and temperature in the column, rates of flow of reflux and reboiler heating oil.

Analysis of conditions show that key operation of the column lies in the temperature controller, which should be located in the column at a sensitive point, usually some few trays above inlet tray.

A modification is the use of a differential temperature controller situated in the rectification section of the tower when the purity of the overhead product is most important, or in the stripping section when purity of bottom product is the more critical of the two.

Another system is the vapour-pressure difference control, using a device which measures the vapour-pressure difference with great accuracy, depending on a simple force-balance system to measure force exerted upon the diaphragm of the difference in the two vapour pressures.

Ten figures illustrate the article. G. A. C.

PRODUCTS.

Chemistry and Physics.

453. Mechanism of Cold Flame Combustion. V. Kondrat'ev, L. Karmilova, and E. Kondrat'eva. *J. Phys. Chem.* (*U.S.S.R.*), 1948, **22**, 561–564; *Rev. Inst. franç. Pétrole*, 1948, **3**, D124.—Utilization of the thermo-electric method based upon the temp difference indicated by a $ZnO.Cr_2O_3$ couple and a normal couple had enabled the concn of H atoms in H_2, CO, and C_2H_2 flames to be measured. Similar apparatus was used for the study of cold flames in an O_2, diethyl ether, and acetaldehyde mixture. Values of temp difference between the couples could not be measured with sufficient accuracy to assert the absence of atomic hydrogen, whose partial pressure would be proportional to such temp difference. Nor could a definite conclusion be drawn from measurements of the reaction velocity. It is, however, concluded that, even if atomic hydrogen is present in cold flames, the part played by it is of far less importance than in the case of normal (hot) flames. The reaction mechanism of these latter is explained. V. B.

454. Oxidation of Normal Heptane in an Autoclave. O. Widmaier and F. Mauss. *Rev. Inst. franç. Pétrole*, 1948, **3**, 255–260.—A brief review is given of the theoretical aspects of hydrocarbon-chain rupture by oxidn. With the aim of studying oxidn under conditions approaching those in an I.C. engine the oxidn of *n*-heptane was carried out in a 1-litre steel autoclave, using 350 ml of *n*-heptane. Temp was measured by a Fe–Constantan couple with the hot junction immersed in the liquid. Tests were made for 16–70 min at 18–67 kg/cm² and 143–173° C. Results are shown in tables and graphically; peroxides are the first products formed, followed by aldehydes and acids. The peroxide val increased rapidly with time, but fell off sharply with a rise in temp. Aldehyde formation increases up to 165°, but thereafter gums are formed at the expense of aldehydes. Acid val increased steadily with temp. Tests for aldehydes by the partition-coeff method of Damköhler and Eggersglüss (*Z. phys. chem.*, 1942, **51**, 157) showed acetic, propionic, and butyric aldehydes to be present. Possible reaction mechanisms are suggested. V. B.

455. Oxidation Reactions of Methane. J. Meunier. *Chim. et Ind.*, 1948, **60**, 550–558.—Possible oxidn reactions of methane are outlined, and their graphical representation by a Gibbs triangle is demonstrated. The static conditions in the homogeneous phase are depicted graphically, and the effect of carbon formed by the thermal dissociation of methane is considered. The influence of variations in temp, pressure, and concn of the reactants are discussed. V. B.

456. Reversibility of the Propagation Reaction in Polymerization Processes and its Manifestation in the Phenomenon of "Ceiling Temperature." F. S. Dainton and K. J. Ivin. *Nature*, 1948, **162**, 705–707.—In studying the copolymerization of olefins and sulphur dioxide, theoretical considerations suggest that, as the temperature increases, the reaction rate should first rise exponentially, then pass through a maximum, and fall to zero at a ceiling temperature $T_c = \Delta H/\Delta S$, where ΔH is the heat of reaction and ΔS is the entropy change per mol of monomer polymerized. The kinetic and thermodynamic arguments which lead to this conclusion are outlined. Experimental data in its support are given for 1-butene, 2-butene, and propylene. H. C. E.

457. Radical Reactivity in the Initiation Reaction of the Polymerization of Styrene. W. Cooper. *Nature*, 1948, **162**, 897.—An empirical measure of the activity of peroxide catalysts in polymerization reactions is given by the product of rate of polymerization of styrene at 70° C $\left(\frac{-dM}{dt}\right)$ and the intrinsic viscosity of the polymer η ; *i.e.*, $\alpha = \frac{-dM}{dt}\eta$. The results for ten peroxides relative to benzoyl peroxide at 0·014 mol/L concentration are shown in a graph of α versus $\frac{-dM}{dt}$. It is deduced that electron-repelling groups increase and electron-attracting groups decrease the activity of the radical. The effect of various peroxides is examined in detail, and it is concluded that an important characteristic of a free radical is the availability of the free electron for reaction with the π-electrons of the double bond. H. C. E.

458. Temperature Lag and Chemical Kinetics. W. S. Horton. *J. Phys. & Colloid Chem.*, 1948, **52**, 1129–1136.—A method is given for computing the concn of reactant to be expected during a kinetic experiment where thermal equilibrium is not instantly attained. The two extreme conditions of no mixing and perfect mixing are considered. Any actual case will lie between these limits, and suggestions are offered for reducing the errors in specific velocity constants determined in such experiments. D. F. J.

459. Adsorption of Water Vapour on Glass Surfaces. R. I. Razouk and A. S. Salem. *J. Phys. & Colloid Chem.*, 1948, **52**, 1208–1227.—Adsorption *iso*therms have been determined for water vapour–glass. The glass was of known composition and was used in the form of fibres, powder, and microspheres. The three surfaces show different adsorptive capacities/unit area of geometric surface. The real surface is *ca* 2–3 × greater than the geometric surface in the case of water-washed glass, and *ca* 10–20 × greater in the case of acid-treated glass. Water adsorbed on glass is partly a firmly held monolayer, and partly a physically adsorbed film.

A survey is made of relevant literature, and thirty-six references given. D. F. J.

Analysis and Testing.

460. Symposium on Rapid Methods of Analysis. J. A. Anderson and others. *Oil Gas J.*, 11.11.48, **47** (28), 264.—A summary of fifteen papers given at two A.P.I. sessions on this subject is given.

Apparatus and experimental techniques for the determination of naphthaline methyl naphthalines and total naphthalines in admixture with other hydrocarbons by ultra-violet absorption is described. Determination of inhibitors in gasoline, use of viscorator (a continuous viscometer) for plant viscosity control, quantitative determination of sulphur in hydrocarbons by X-ray absorption continuous determination of CO and CO_2 in pilot-plant and refinery operations using an infra-red gas analyser, determination of dissolved oxygen in hydrocarbon oils, rapid method of stack-gas analysis, and a method for determining stripped efficiency are among methods dealt with. G. A. C.

461. Evolution of the Equilibrium Still. R. T. Fowler. *Industr. Chem.*, 1948, **24**, 717–721, 824–830.—Methods of obtaining boiling temp and equilibrium samples of liquid and vapour are critically surveyed. Apparatus used from the earliest times to most recent investigations is described, and the operation of many illustrated with diagrams. Difficulties and errors inherent in the various methods are discussed. Twenty-seven references. E. B.

462. Electron Microscope for Oil Research. C. A. Moore. *World Oil*, July 1948, **128** (3), 135.—The electron microscope has a magnification of 100,000 dia as compared with 2000 dia for the optical microscope. Fundamentally it consists of an electron beam concentrated on to the specimen, by a magnetic coil. The beam is then focused to an intermediate image and then on to a photographic plate by other magnetic fields. Areas can be scanned rapidly, although the area photographed is only 0·01 mm square. Specimens are mounted on a collodion film on a 400-mesh screen. The

specimens are under a vacuum of 10^{-4} to 10^{-5} mm of mercury and are subjected to an intense electron bombardment which may cause deterioration. At present the instrument is being used extensively in biological studies. Possible applications of the electron microscope are: (1) identification and correlation of clays; (2) studies of crude oil; (3) palæontological investigations.

A bibliography is appended. C. G. W.

463. Surface Area Measurements of Fine Powders using Modified Permeability Equations. P. C. Carman and J. C. Arnell. *Canad. J. Res.*, 1948, **26 A** (3), 128–136.—The several modified Kuzeny equations have been compared. All give similar specific surface areas for a set of experimental data. D. F. J.

464. Recent Advances in Rheology. Proceedings of the International Rheological Congress in Holland. A. de Waele. *Paint Technol.*, Nov. 1948, **13**, 477.—The first International Rheological Conference in Holland commenced on September 20, 1948. The communications were divided into two groups, general and sectional. The latter was subdivided into Theoretical Problems, Experimental Methods, Rheological Properties of Various Systems, Biological Systems, and Industrial Applications. Great interest was focused on stress–shear diagrams of materials exhibiting departure from Newtonian Flow. Problems of intrinsic viscosity ratio at varying concentrations, particle size, and shape of large linear molecules and dispersed lyophobe particles are considered. The standardization of Rheological Nomenclature was discussed.

The selection of special methods will be guided by mechanical and molecular models conjectured from the investigatory date. Among them is the concentric-cylinder apparatus for constant rotation, for constant stress and recording elastic stress.

The processes that necessitate rheological investigations in industry and the properties of raw materials and finished products were reviewed. Dr Houwink worked on viscosity coefficient and yield value only.

Several papers appertaining to non-Newtonian phenomena in fluids or pseudo-fluids were presented. Sir Charles Goodeve gave a short lecture illustrating his mathematical interpretation of "plastic memory."

An unorthodox approach to the elucidation of the problem of formation and destruction of particle structure under shear, by selecting a method wherein solid–liquid interaction in dispersed systems can be eliminated, was shown in a paper by Dr Voet. The dielectric constant could be determined whilst under high shear stress and at rest in a high-precision rotary viscometer. All Newtonian fluids were found to be associated with an agglomeration factor of unity. The rate of increase of this factor with the square root of elapsed time showed the process of reflocculation to be one of diffusion.

An unusual form of viscometric balance, an extrusion plastomer, and a viscometer for measuring visco-elastic properties of high-polymer solutions were described. Papers were read on turbulent flow and Reynold's Numbers, and on the use of a Stormer viscometer to determine the rheological behaviour of an unstable settling suspension.

Messrs Waele and Mardles gave a survey of evidence bearing on the effect of possible lyosorption, wettability, flocculation, rigidity, and thixotropy of suspensions.

Factors pertaining to the necessary and desired properties of printing inks were discussed.

Two distinct yield stresses in lubricating greases respectively characterized by inception of plug flow in a capillary, and the continuation of such flow as a plug bounded by a thin streamline shell were discussed..

Two papers presented by Pouradier may have implications for the stabilization of emulsions by interstitial films. D. K.

465. Raman Spectrography. L. Robert. *Rev. Inst. franç. Pétrole*, 1948, **3**, 245–254.—A general description of the Raman effect is given; the advantages of using as receiver a photo-electric cell whose currents are amplified by an electronic tube are pointed out. Examples are given of applications of Raman spectra in hydrocarbon analysis and of its use in identifying various chemical groups and linkages. It can also be used in studying polymerization reactions, and the resolution can be sufficiently great to differentiate isotopes within a molecule. Comparison is made between

Raman and infra-red methods, and attention is drawn to the advantages and limitations of each method. Raman spectra can be used for mixtures containing water, whose intense absorption in the infra-red masks the effect due to other constituents. Twenty-three references. V. B.

466. Fuel Evaluation on the Basis of Vapour Lock Tendency. K. W. Schneider and A. Grünwald. *Erdöl u. Kohle*, 1948, **1**, 116–120.—Factors influencing the cut-off point at which the vapour lock in a fuel system interrupts fuel supply are discussed. This point is influenced by the V/L ratio (K value), where V is the vapour vol and L the liquid vol delivered by the fuel-supply system. A laboratory apparatus consisting essentially of a long glass U-tube is described whereby the influence of temp and pressure on the V/L ratios of fuels in the range 1 to 20 can be determined. The results obtained with this apparatus enable curves to be constructed whence the behaviour of a fuel in various types of engines and under various operating conditions can be predicted. The effect of solution of air and water in the fuel is reflected in the results obtained, as it would be in actual operation. Test figures are given on eleven fuels of various types, including benzole and alcohol mixtures, together with the merit rating of the fuels as indicated by the V/L isochores, the A.S.T.M. 10% dist temp and the Reid v.p. The temp at which the latter equals 1 atm gives the nearest approach to the rating deduced from the V/L curves. V. B.

467. Improved Viscometer. H. R. Jacobs. *Rev. sci. Instrum.*, 1948, **19**, 816.—The apparatus consists of two reservoirs connected by a horizontal capillary tube and associated devices which drive the liquid through the capillary so that, when the liquid level rises in the receiving reservoir, the air pressure driving the liquid from the discharging reservoir rises in exact measure. The air pressures in the two parts of the apparatus represent exactly the hydrostatic pressures at the two ends of the capillary, and the difference is read on a manometer. The average time taken for a known amount of liquid to flow through the capillary is taken for a number of passages in both directions, to eliminate the effect of the capillary tube not being perfectly horizontal.

Advantages of this instrument are: (1) hydrostatic effects of density are eliminated; (2) surface tension effects are minimized; and (3) rates of flow can be measured over a wide range of pressures. H. C. E.

Crude Oil.

468. Refining Saudi Arabia Crudes. G. Egloff. *Oil Gas J.*, 30.12.48, **47** (35), 159.—A review of the Saudi Arabian petroleum industry is given. The characteristics of the crude oil, which is predominantly paraffinic, is typified by those of the Abqaiq, which represents two-thirds of the production. Oil of similar characteristics is obtained from the Damman field, and small amounts from Qatif.

Tables show Hempel Fractionation and properties of fractions for the two main crudes, crude break up, properties of reformed products, evaluations for lubricating oil production, thermal cracking and properties of cracked products, and fluid-flow catalytic cracking of Arabian gas oil.

It is estimated that the industry in Saudi Arabia will soon rank as third largest exporter of petroleum and its products. G. A. C.

469. Refining South American Crudes. G. Egloff. *Oil Gas J.*, 30.12.48, **47** (35), 263.—A review is given of the properties of South American crude oils, including oils from Argentina, Colombia, Peru, Ecuador, Bolivia, Brazil, Chili, Venezuela, Poza Rica, and Mexico.

Properties and cracking of Poza Rica stocks, and operating conditions are also tabulated. G. A. C.

Gas.

470. Grade and Yield Estimation of Natural Gasoline. D. Seeley. *Oil Gas J.*, 30.9.48, **47** (22), 86, 90.—Grade limits of natural gasoline in the N.G.A.A. specifications are Reid v.p. 10–34 lb, percentage evaporated at 140° F 25–85 lb. To obtain maximum yield of a given grade product, the limiting Reid v.p. (maximum percentage butanes) is approached as closely as possible.

In evaluating the possible plant products which are available, no exact yield–grade relationship can be established. Yield and grade of products from a gas of given composition can, however, be obtained approximately by assuming that: (1) hexane plus portion of natural-gasoline fraction has physical properties of normal octane; (2) butanes (*iso* and normal) recovered will be one-third *iso* and two-thirds normal. It is then possible to define various grades of natural gasoline by the pentane (C_5) ratio, and the percentage of butanes in the final gasoline mixture. The C_5 ratio is the liquid vol-% of *iso* and normal pentane in the pentanes-plus portion of the mixture.

Conversion of mol or vol-% to liquid content in terms of g.p.m. and the C_5 ratio can be accomplished by use of a figure included in the text.

Examples are worked out to illustrate the method. W. M. H.

Engine Fuels.

471. Exhaust Gas and its Conditioning. A. E. Hancock. *Gas Oil Pwr*, 1948, **43**, 326.—Present regulations call for a CO content of $<0{\cdot}5\%$, and there is no difficulty in keeping well below this figure. The amounts of CO in exhaust gases under various conditions at different stages in the life of an engine are given. Since high-CO figures are an indication of poor combustion, good maintenance will lead to good CO results.

The function of the conditioner is to remove aldehydes, and the best results are obtained by thorough scrubbing. This procedure also dissolves oxides of nitrogen and sulphur, and the liquor becomes very corrosive. The conditioner has therefore to be made of stainless steel. H. C. E.

472. Diesel Fuel Oil. C. G. Williams and A. Wilson. *Mech. World*, 1948, 124, 558.—Details of investigations at Thornton Research Centre of Shell Refining & Marketing Co. are published under the following headings:—

Cold Starting: In temperate climates high Cetane No. is more important than volatility. The opposite applies for Arctic conditions. In the latter case, if ether is used as an auxiliary aid, care should be taken to avoid excess.

Diesel Knock: Cetane No. of the fuel is the factor which governs this phenomenon to the greatest extent. Knock can be suppressed by pilot injection, *i.e.*, introduction of a minor charge into the combustion chamber followed by the main part of the charge, after a suitable delay. Supercharging has been found to eliminate knock completely.

Wear: Cylinder wear is due to the presence of abrasive particles, to metallic contact between piston-ring and cylinder wall (particularly at the upper end of the ring travel on the firing stroke), and to corrosion, which is due to acid condensation in the cylinder. Of the two satisfactory methods for reducing corrosion wear—control of cylinder-wall temperature and the incorporation of additives in the lubricating oil—the latter is most attractive.

Fouling: This takes three forms: sludging in the crankcase, piston deposits, and nozzle fouling.

It has been shown that combustion products are the main components of crankcase sludges. The inclusion of detergent additives in the lubricating oil is one way of tackling this problem. The effect of combustion-chamber design is being investigated, and it has been shown that high gas movement over the upper surface of the cylinder removes the oil film, thereby increasing oil consumption and causing deposition of unburnt fuel particles.

Ring-sticking is one of the most serious forms of piston fouling and is often due to engine design. Ring-groove temperatures above 200° C are dangerous in this respect, but the trouble can be alleviated by use of additive-type lubricants.

Nozzle fouling, which affects engine performance considerably, is exhibited in several different forms which may not be interrelated. Basically, fuel is responsible for this defect, but it would seem that fuel properties are possibly insignificant compared with temperature effects.

Exhaust Smoke: Experience has shown that, while smoke-density measurement is a valuable check on performance of a particular engine, its reliability for comparing exhausts of different engines is questionable. Distribution of fuel in the air is an overriding factor in causing exhaust smoke, but it is felt that other fuel factors (apart from volatility) which are not yet understood are also important. O. M.

473. Colloidal Fuels for Diesel Engines. L. C. Verman, K. A. Nair, M. L. Khanna, and S. K. Dasgupta. *Gas Oil Pwr*, 1948, **43**, 330–332.—Vegetable oils are not able to compete with mineral oils as fuel for diesels because of their high cost, but experiments show that colloidal charcoal in such oil can be burnt in a diesel engine. It is found that a 35% suspension of colloidal charcoal in groundnut oil is stable if 3% of the calcium soap of groundnut oil is added. This fuel was used in an 8-h.p. single-cylinder Lister engine of 4¼-in bore and 4¼-in stroke under the following operating conditions :—

Speed	1200 r.p.m.
Air-intake temperature	37·5 ± 0·5° C
Radiator-water-outlet temperature	80 ± 0·5° C
Compression ratio, 2 h.p. to full load	15 : 1
„ „ less than 2 h.p.	19 : 1
Room temperature	17·5 — 19·5° C
Relative humidity	47–64%

Clear exhausts were obtained with mineral and groundnut oils at all except maximum load; with colloidal fuel a trace of black smoke was obtained at reduced loads, and more at full load. The maximum b.h.p's obtained for mineral oil, groundnut oil, and colloidal fuel were 100, 98·7, and 72·8% respectively, but there were indications that with the colloidal fuel the air and fuel mixing was not efficient. The tests had to be discontinued because of excessive wear to the injection system. (See also Abstract No. 1442 [1948].) H. C. E.

474. Tables for Numerical Solution of Problems in Compressible Gas Flow with Energy Effects. A. H. Shapiro and G. M. Edelman. *J. appl. Mech.*, 1948, **15** (2), 169–175.—May be used for such processes as heat transfer at high gas speeds, combustion, moisture-condensation shocks, flame fronts, and detonation waves. D. F. J.

475. Mechanics and Thermodynamics of Steady One-dimensional Gas Flow. A. H. Shapiro and W. R. Hawthorne. *J. appl. Mech.*, 1947, **14** (4), A-317–A-336.—A one-dimensional analysis for flow without shocks is presented which takes into account the simultaneous effects of area change, wall friction, drag of internal bodies, external heat exchange, chemical reaction, change of phase, injection of gases, and changes in mol. wt. and sp. ht. D. F. J.

476. Tables for Numerical Solution of Problems in the Mechanics and Thermodynamics of Steady One-dimensional Gas Flow without Discontinuities. G. M. Edelman and A. H. Shapiro. *J. appl. Mech.*, 1947, **14** (4), A-344–A-351.—The tables facilitate the numerical solution of problems such as those dealt with in a previous paper (see Abstract No. 475 [1949]) where the stream properties change continuously. D. F. J.

477. Survey of Commercial Aviation-Gasoline Characteristics, July 1948 Production. W. C. Holliman, M. G. Barker, and N. Bobrowski. *U.S. Bur. Mines Rep. Invest.* 4435, Nov. 1948, pp. 17.—Tabulation of company inspection data and Bureau of Mines laboratory data on sixty-six samples of commercial grades of aviation spirit in production in July 1948. G. S.

478. Survey of Commercial Aviation-Gasoline Characteristics, January 1948 Production. W. C. Holliman, M. G. Barker, and N. Bobrowski. *U.S. Bur. Mines Rep. Invest.* 4424, Nov. 1948, pp. 16.—Data on sixty-eight samples of aviation gasolines in production in the U.S.A. in January 1948. The tabulations include inspection data from fifteen manufacturers and special data obtained in the Bureau of Mines laboratories. G. S.

479. Introduce New Anti-detonant in Ohio Gasoline Stations. Anon. *World Petrol.*, 1948, **19** (12), 90–91.—A device is described for the automatic injection of a mixture of ethyl alcohol, water, and T.E.L. into the engine manifold during acceleration and hill climbing.

An improvement of 10–20 units in O.N. is claimed at lower cost than by equivalent refining, and periods between major overhauls are lengthened. E. B.

480. Knock Preventer. Anon. *Amer. Automobile*, Nov. 1948; **25** (11), 25.—Based on the system established during the war whereby injection of 50/50 methanol–water into fuel allowed aircraft to have much increased power for short periods, the instrument known as the Vitameter has been developed for use by motor cars. This accessory is actuated by drop in inlet-manifold vacuum on open throttle and feeds measured quantities of Vitol (85% methanol, 15% water containing 3 c.c. T.E.L./gallon and a soluble oil). This injection serves to raise the rating of the entire fuel mixture by 10–20 O.N., thus allowing modern engines of relatively high-compression ratio to use low-grade gasolines. An added advantage is that, using Vitol, engine deposits are soft and easily removable. O. M.

481. "Knock" in Internal Combustion Engines. D. Downs, A. D. Walsh, and R. W. Wheeler. *Nature*, 1948, **162**, 893.—Gas samples have been extracted from the cylinder of a Richardo E6 variable-compression engine operating at 1500 r.p.m. over a period of 3° crank near T.D.C. Their aldehyde content and total organic and hydrogen peroxides have been measured. Using technical *iso*-octane as fuel, it is found that as the compression ratio is increased, "knock" develops and the peroxide concentration increases, giving also a much higher peak value near the point of flame arrival. The aldehyde concentration of the gas is parallel with that of the peroxides, but the peak concentration of the former is some thirty times greater than that of the peroxides. The effect of T.E.L. addition is to lower the concentrations of both peroxides and aldehydes. H. C. E.

482. Research Octane Numbers Show Improvement. (Report of American Chemical Society Meeting.) A. L. Foster. *Petrol. Engr*, Sept. 1948, **19** (13), 171.—For improvement in performance and economy of I.C. engines, increase of compression ratio and hence of O.N. is required. Difference between the motor- and research-method octane ratings is greatest for fuels containing relatively large amounts of aromatics, naphthenic, and *iso*paraffinic compounds. These components are produced by most of the processes, *i.e.*, catalytic cracking, hydroforming, etc., used by the refining industry. Engines of C.R. of 8 : 1 require fuel of 79 and 90 motor and research rating respectively, while a 12·5 : 1 C.R. requires a fuel of 100 research and 88·5 motor rating. The engine efficiency increases with increase of C.R.

Synthetic gasoline produced by the Hydrocol process produces a highly olefinic fuel of high O.N. contrasting with the poor fuel produced in Europe by similar processes.

Addition of aromatics up to 25% to aviation blends increases the power output in varying percentages.

Blend O.N. can be calculated from the O.N. of the components with a high degree of accuracy. G. K. A.

483. Cold Starting. C. Ridley. *Auto. Engr*, 1948, **39**, 21.—It has been found that ease of engine starting under cold conditions can be greatly increased by continuously forcing a stream of a relatively wide-cut mixture of several volatile hydrocarbons of differing boiling points into the intake manifold, quite independently of the air stream.

The mixture which is most suitable for this purpose contains the following hydrocarbons, both paraffin and olefin, which should embody a substantial proportion of the *iso*-compounds: C_3 up to 5%; C_3 from 10 to 25%; C_4 from 15 to 45%; and C_5 from 30 to 40%. There should also be added C_6 to C_8 hydrocarbons from 10 to 25% with, or without, ordinary or aviation gasoline. The composition of this fuel is such that it vaporizes in a proportion that always forms an explosive mixture with air.

It is thought that this fuel is an effective cold-starting material, because its widely separated explosive limits allow it to deal with the very rapid changes of temperature which occur when an engine is starting up in very cold climates. O. M.

484. American Tractor Fuels. Anon. *Gas Oil Pwr*, 1948, **43**, 370.—During the years 1933–41 the fuel consumption of American tractors remained stationary. The h.p.hr. per U.S.G. of fuel averaged 11·98 for diesel fuels, 7·78 for gasoline, and 8·46 for distillates. H. C. E.

Gas Oil and Fuel Oil.

485. Recent Research on Fuel Injection. A. T. Priddle. *Gas Oil Pwr*, 1948, **43**, 351–352.—Diesel knock and combustion efficiency are greatly affected by the rate at which fuel is injected into the cylinder. The rate is primarily controlled by the cam profile and the diameter of the pump plunger, but at high speeds it is well known that the injection period at the nozzle exceeds the time required to complete the pumping stroke. An apparatus is described which establishes a relationship between the nozzle- and pump-injection rates. The results show that the injection rate at the nozzle fluctuates markedly during the injection, and at 600 camshaft r.p.m. the flow continues for at least 6° camshaft angle after the pump delivery has stopped.
H. C. E.

486. Fuel Research and the Heating and Ventilating Engineer. Anon. *Heating Ventilating Engr*, 1948, **21**, 224.—A current investigation in the U.S.A. is concerned with problems in the combustion of fuel oils from catalytic-cracking processes. Such fuels may have quite different burning properties from fuels from straight-run distillation processes, although of similar physical properties. A committee of the Oil Heat Institute developed a Combustion Reference Test Unit in which various types of fuel could be burned and the combustion characteristics measured to establish a rating for each fuel. The purpose is to find an apparatus that would do for fuel oils what the octane-rating engine does for gasolines. D. W. J.

Lubricants.

487. Lubrication-oil Improver. A. B. Boehm. *Oil Gas J.*, 11.11.48, **47** (28), 335.—A review of additives for lubricating oils is given. Pour-point depressants, gear-oil additives, additives for special diesel oils, and V.I. improvers are commented upon, as well as premium motor oil and other additives. Effects in use and future trends are discussed. G. A. C.

488. Keeping the Wheels Turning; the Vital Part Played by Lubricating Oil Additives. A. E. Hope. *Scientific Lubrication*, Oct. 1948, **1**, 11–13, 20.—The development of motor lubricating oils is described, and the properties of solvent-refined lubricants indicated. The special functions of engine testing and of chemical additives are outlined and the respective fields of regular, premium and heavy-duty oils differentiated. The effects of variations in fuel quality on lubrication phenomena are discussed, together with general, gear, and hypoid lubricants. J. G. H.

489. Application of Colloidal Graphite to some Lubrication Problems. A. H. Stuart. *Scientific Lubrication*, Oct. 1948, **1**, 15–17, 24.—Phenomena of pressure distribution, film rupture, and seizure under conventional lubricating conditions are discussed, and the special properties of graphite as a lubricant are enumerated. Applications to fabric bearings, running-in new machinery, upper-cylinder lubrication, and metal drawing are described. J. G. H.

490. Continuous Process for Lubricating Greases. H. G. Houlton, A. E. Calkins, and A. Beerbower. *Chem. Engng Prog.*, 1947, **43** (8), 399–404.—A continuous process for the production of lime grease is outlined which is equally adapted to the production of other greases, where it is of value to manufacture the soap component in the grease plant. The concentrated soap stock is first prepared and continuously blended with mineral oil producing high-quality lime grease at 60 lb/min. Plant operation details, a flow sheet, and cost data are included. J. G. H.

491. Mechanism of Grease Lubrication Re-examined. Anon. *Chem. Eng. News*, 1948, **26**, 3198.—Experimental and theoretical evidence, in support of the view that the mineral-oil portion of a lubricating grease is a carrier for the dispersion of the soap which is the real lubricant, was presented at the annual Lubricating Grease Institute. Separation of the twenty-one component fatty acids in fats has been perfected as a commercial process. E. S. E.

492. Future Lubricants. G. J. C. Vincall. *Scientific Lubrication*, Oct. 1948, **1**, 7–10.—The historical development of lubricants up to solvent-refined, E.P., and hypoid oils is outlined, and the functions of engine tests and additives are discussed. Applications of synthetic oils are indicated, and Ucon, Prestone, and Plexol oils are described together with silicones. The theoretical basis of recent developments and the function of metallic soaps are discussed. J. G. H.

493. Lubrication of Land and Marine Oil Engines. Anon. *Scientific Lubrication*, Oct. 1948, **1**, 3–6.—The larger type of vertical multi-cylinder totally enclosed dry-sump engine is considered as a typical installation. The effects of modern design and operating conditions on lubrication requirements are stressed, and pressure-circulation systems are described, components covered including priming pumps, oil coolers, filters, and flow indicators. The system employed for crankshaft lubrication is outlined, and a brief note included on non-circulating systems. J. G. H.

Bitumen, Asphalt, and Tar.

494. Bituminous Road Surfaces. Anon. *Rds & Rd Constrn*, Dec. 1948, **26**, 469.—The introduction of laying machines for putting down all forms of plant-mixed bituminous surfacings, hot and cold asphalt, etc., is the most important recent development in road construction. Each machine lays 180–250 tons/day. New problems arise from this, *e.g.*, difficulties of supply, necessity for different specifications, the amount of rolling necessary is not known.

It is suggested that new tests are necessary for determining the size of aggregates used in road work and which will give results correlating with road performance. The Aggregate Crushing Value meets the first requirement.

A study of adhesion of bitumen mixtures in the presence of water is being made, probably stimulated by the marketing of chemical agents which give immediate and positive improvement of the adhesion to typical aggregates in laboratory demonstrations. On the short term, break-up of surfacings almost immediately after laying sometimes occurs. Examination shows the following facts: (1) stone to be stripped of binder; (2) abnormal amount of water in the surfacing; (3) some mixtures in other places give good surfaces; (4) certain classes of aggregate appear more frequently than others.

On the long term, failures are due largely to change in the properties of the binding medium or loss of adhesion between stone and binder.

Special attention should be paid to drainage and adhesion for durable surfacings. Tests to determine if adhesion has reached a required standard include the bottle test, boiling test, Riedel and Weker, and the immersion–compression test; the latter seems the best, but more experience is needed before standardization could be considered.

In selecting an adhesion agent, it should be known to be efficient after storage in a heated storage tank for a week, to have no deleterious effects on the binder, and that the improvement of adhesion should be retained over a long period. D. K.

495. Filling and Sealing Materials for Joints in Concrete Roads. R. S. Millard. *Rd & Rd Constrn*, July–Aug. 1948, **26**, 239–244, 279–285.—A description is given of an investigation by the Road Research Laboratory to define the requirements of good concrete joint-filling and sealing materials and to determine which types of material most closely fulfil these requirements. The types of joint fillers considered were: soft wood, impregnated fibreboard, cork, cellular rubber, sheet bitumen between paper felt, and bitumen containing cork granules. Whilst the first four were compressible without extruding, the bitumen compounds were condemned on account of their extruding under pressure.

Available sealing compounds are classified as resinous, straight-run bitumen, oxidized bitumen, and rubber-containing compounds. Causes of failure are described, and the value of priming as a means of increasing adhesion is stressed. The development of suitable performance tests and test apparatus in line with British, as opposed to American conditions, is outlined, the tests comprising applications, hot-weather and cold-weather conditions. The possibilities of accelerated weathering tests are discussed. J. G. H.

Special Hydrocarbon Products.

496. Aerosol Generator Applications of D.D.T. for Codling Moth Control. L. G. Gentner, H. E. Morrison, and W. B. Rasmussen. *J. Econ. Ent.*, Feb. 1948, **41** (1), 67.—During 1946 experiments were carried out in Oregon to determine whether D.D.T. is effective against codling moth on Bartlett pear-trees when applied by an aerosol generator. There were four applications; the first two D.D.T. in xylene, and diluted with oil; the third oil, containing D.D.T., and the last D.D.T. dissolved in xylene and oil and emulsified. The fog was forced into the trees from one side of each row only. Results for control of codling moth were very satisfactory, and achieved a saving of at least 59% over the application of D.D.T. wettable powder by means of conventional spray machinery. W. M. H.

497. A System of Sampling and Rating Codling Moth Infestations. C. H. Richardson. *J. Econ. Ent.*, Feb. 1948, **41** (1), 75.—The method proposed takes pre-harvest infestation data, and uses the lower peripheral area of the tree as the sampling unit. Apples are tallied according to one or several criteria of infestation by chance within this area without removing them from the tree. Trees may be sampled from the ground at any time before or during harvest without any inconvenience or loss, and results may be used for the evaluation of insecticides or spreaders.

Various criteria are discussed, the most convenient one being total number of blemished (infested) fruit per unit sample, this being adequate for the detection of practical differences between insecticides.

There are six literature references. W. M. H.

498. Oil Spray Investigations in British Columbia. J. Marshall. *J. Econ. Ent.*, Aug. 1948, **41** (4), 592.—An investigation on spray oils was begun in British Columbia in 1939, and is continuing. It recommends use of a high-viscosity dormant oil and a summer oil of low unsulphonated residue. High-viscosity dormant oil is more effective against San José scale and European red mite than that of low viscosity, but less effective against apple mealy bug. Applied undiluted to trunks over six years, fuel oils and light summer oils are more injurious than light dormant oil, and light dormant oil more injurious than heavy dormant oil. Summer oil of low unsulphonated residue, used at 0·5% concentration in five applications, does not appear more injurious to apple fruits or foliage than oil of high unsulphonated residue, neither does residual fuel oil.

There are two literature references. W. M. H.

499. Comparison of Methods for Testing Repellant-Type Fly Sprays. H. C. Fryer, F. W. Atkeson, and R. C. Smith. *J. Econ. Ent.*, Feb. 1948, **41** (1), 80.—A critical comparison is made between whole-cow and half-cow methods for conducting field tests on cattle-fly repellants. The whole-cow research employed latin squares for the conduct of the experiment, while the half-cow tests used a symmetrical-pairs design.

The whole-cow method was found to be definitely superior in the field, and to give much more reliable results, since the half-cow technique is rendered almost useless by interference between the two sprays on the same cow. Main conclusions are:

(1) Susceptibilities of cows to flies should first be determined, and when to start counts after spray is applied;
(2) cows should be segrated into groups of three or more;
(3) a latin-square design should be used;
(4) periodical counts should be made of number of flies on each cow of each group;
(5) fly counts must be transformed into mathematical measurements of repellancy which approximate to a normal frequency distribution;
(6) t-test and F-test techniques are available for analysis of data.

There are five literature references. W. M. H.

500. Requirements of Petroleum Solvents in Pigmented Textile Printing Pastes. R. A. Billmeier. *Amer. Dyestuff Rept.*, 1948, **37**, 748.—The effect on performance characteristics of varying the hydrocarbon type composition of petroleum solvents used as thinners for the concentrates used in printing with pigmented pastes, was investigated.

A mineral spirit having 16–20% aromatic components, with the balance consisting of equivalent volumes of paraffins and naphthenes, gives the best overall performance.

Solvent composition directly affects the body of the emulsion, which to some extent is a controlling factor in textile penetration. Both high and low aromatic contents result in excessive emulsion thinning. High concentrations of paraffins, especially at low-aromatic levels, result in unstable as well as thin emulsions. The emulsion stability is greatest at high aromatic and/or naphthene concentrations, but such increased stability is always associated with a loss in body. The optimum colour strength is not the same for different paraffin–naphthene ratios, and is greatest at a ratio of about 1 : 1. At this figure, the greatest strength is attained at an aromatic concentration of 16–20%, and a spirit having this composition also gives the optimum balance of good body with reasonably high stability. C. N. T.

501. Mineral Oils in Bread. J. B. M. Coppock and M. A. Cookson. *Brit. Med. J.*, 1949, i, 73.—A study of the distribution of mineral oils in bread, resulting from their use as lubricants and tin-greasing agents, has been made. Small amounts thus mixed with dough are unlikely to be liberated internally and will probably be excreted with the roughage. It is suggested that the max mineral oil content of bread should be 2000 p.p.m., the oil to be at least equal to liquid paraffin, B.P. quality. A survey of breads now produced in Great Britain shows that the majority of samples fall within the proposed limit. (See Abstract No. 1458 [1948].) V. B.

Derived Chemical Products.

502. Commercial Synthesis of Glycerol Begins at New Shell Chem. Corp. Plant. Anon. *Chem. Eng. News*, 1948, **26**, 2770–2771.—The world's first commercial synthetic glycerol plant at Houston is now on stream. Discovery of a feasible process for converting propylene to allyl chloride made the synthesis of glycerol a practical proposition. Chlorination of propylene to allyl chloride is effected at 500° C at which temp the addition reaction is largely inhibited. Conversion of allyl chloride to glycerol is via the chlorhydrins. Glycerol of 99% purity is obtained by conc., desalting, extraction, and distillation. E. S. E.

503. Petroleum Chemicals Reviewed. R. F. Goldstein. *Petrol. Times*, 19.11.48, **52**, 1016.—(1) *General.* A review is made of probable future development and expansion. Present trends indicate that the era of cheap chemical raw materials has passed. Propane and butane are more valuable as domestic fuels than as raw materials for aliphatics. By-products of synthetic plants such as Fischer–Tropsch may prove an important source.

(2) *Use of natural gas for ammonia and methyl alcohol.* Ammonia is made from natural gas by using the natural gas as a source of hydrogen. For methyl alcohol, the natural gas is converted to a " synthesis gas " ($CO + 2H_2$) which is converted to methyl alcohol by catalyst reaction at high temperature and pressure. History of some processes for these conversions are discussed.

(3) *New Products.* Only points dealt with here are the manufacture of Acrolein CH_2:CHCHO from petroleum and the " OXO " reaction. Acrolein is important as a chemical intermediate and for making resins, insecticides, etc. The " OXO " reaction gives normal or branch-chain aldehydes by addition of CO and H_2 to an olefinic double bond. Acids and alcohols can be obtained from the aldehydes.

Seventeen references are appended. C. G. W.

Miscellaneous Products.

504. Terylene, the New British Fibre. W. H. Cady. *Amer. Dyestuff Rept.*, 1948, **37**, 699.—Terylene is a polyester derived from ethylene glycol and terephthalic acid, the latter chemical being a by-product in the manufacture of phthalic anhydride from petroleum. The research leading to the production of Terylene fibre and the points of similarity to, and difference from, Nylon are described. Its different chemical constitution confers certain physical properties which make the product well adapted for weaving and knitting. Its resistance to chemical action should recommend it for filter cloths. C. N. T.

505. Flow Properties of Pseudo-Plastic Fluids. Part 1. Viscosities of GR-S Latices. C. C. Winding, G. P. Baumann, and W. L. Kranich. *Chem. Engng Prog.*, 1947, **43** (10), 527–536.—The investigations described were part of a programme on the properties of synthetic-rubber latices obtained in the copolymerization of butadiene and styrene. The flow properties of Newtonian and non-Newtonian fluids are described, together with an outline of the mechanism of pseudoplastic flow. The effect of ageing on the limiting viscosity is explained, and the thixotropic properties of GR-S indicated. J. G. H.

506. New Synthetic Rubber and Oil—Type Carbon Black make the Best Tires. L. R. Sperberg, L. A. Buss, and C. C. Biard. *Oil Gas J.*, 9.12.48, **47** (32), 70.—The various major classes of carbon blacks have been investigated in 41° F rubber (Philprene A) and compared to similarly loaded black compounds prepared from G.R.-S and smoked natural rubber.

Philprene A possesses a much higher elongation than G.R.-S; percentage resilience test values show that it has a lower hysteresis loss than G.R.-S, but a higher loss than natural rubber. Data show Philprene A and G.R.-S to be similar but superior to natural rubber in abrasion resistance, and the former stocks give considerably stiffer products than either G.R.-S or natural rubber, and extrusion rates are higher. Road-tests results favour Philprene A, and show it to impart better cut and crack-growth resistance. G. A. C.

507. GR-S Latex Processing Equipment. W. H. Pahl. *Chem. Engng Prog.*, 1947, **43** (10), 515–522.—GR-S processing, being a war-time development, has necessitated a period of experimental operation in order to formulate practical-equipment requirements. The actual process is briefly described, followed by data on the chemical and physical characteristics of latex. Whenever possible, surfaces in contact with latex should be physically smooth and chemically resistant, and equipment should be so designed as to present a minimum of recesses and fittings in which stagnation or accumulation can occur. Details of reactors, blowdown and flash tanks, stripping columns, blend tanks, and pumps are set out, together with data on the instruments installed. J. G. H.

Engines and Automotive Equipment.

508. Dart Details. Anon. *Flight*, 2.12.48, **54**, 651.—Preliminary details are given of Rolls Royce's small turbo-prop engine. The principal features are two-stage centrifugal compressor and two-stage turbine. There are seven combustion chambers of the downstream-injection type. Fuel is supplied to the burners between 40 and 800 p.s.i. by a swash-plate plunger-type pump. Sea-level performance at 400 m.p.h. and maximum cruising—turbine r.p.m. 13,000, shaft h.p. 910, thrust lbs 17, fuel consumption g.p.h. 96. I. G. B.

509. Small Agricultural Diesel Tractor. Anon. *Gas Oil Pwr*, 1948, **43**, 366.—The Coventry Victor single-cylinder water-cooled engine has a rating of 9 b.h.p. at 2200 r.p.m. and 7 b.h.p. at 1500 r.p.m. The bore and stroke are 85 and 100 mm. The inlet valve opens about 3° before T.D.C., and fuel is injected through a pintle nozzle. The crankcase has a capacity of 6½ pts, and a gear-type pump supplies oil at a pressure of 20–30 p.s.i.

The Newman tractor which is powered by this engine has a forward speed of up to 10 m.p.h. and a reverse speed of 1·2 m.p.g. The drawbar pull is 1500 lb in first gear and 1200 lb in second gear. H. C. E.

510. Diesel Locomotive. Anon. *Midwest Engr*, 1948, **1** (3), 8–11.—The development of the diesel locomotive in the U.S. is traced from the gasoline rail-car in 1905. The application of electric transmission to the diesel unit was begun in 1923, and 500 cars of this type were built between 1923 and 1930. In 1933 a two-cycle diesel engine appeared in which the weight was only one-fifth, and the size one-fourth, of previous figures, and eventually in 1939 a 54,000-h.p. freight locomotive was constructed.

The advantages of diesel locomotives include: (1) decrease in operating and maintenance costs; (2) higher availability; (3) less track wear; (4) faster scheduled

operation; (5) longer times between major overhauls; (6) uniform operation under all conditions. The economics of the locomotive, and the opinion of the passenger are briefly indicated. H. C. E.

511. British Marine Gas Turbines. T. W. F. Brown. *Motor Ship*, Jan. 1949, **29**, 404.—Extracts are given from the paper read before the N.E. Coast Institution of Engineers and Shipbuilders on December 10, 1948, and a few references are made to the grade of fuel to be used in marine gas turbines. I. G. B.

512. Gas Turbines for Road Transport. R. H. H. Barr. *Gas Oil Pwr*, 1948, **43**, 371–377.—A gas turbine in a motor car allows the overall height to be reduced without loss of headroom, and structural freedom results because no radiator is necessary. The thermal efficiency of a gas turbine compares favourably with reciprocating engines; however, scaling down will reduce the efficiency because: (1) it is then more difficult to work to the same comparable limits; and (2) the gas friction losses increase. The first effect is not serious; calculations show that the second effect would cause a decrease in overall engine efficiency of 15–20%.

Since the work delivered by a turbine varies as the square of the peripheral velocity of the blading, very high rotor speeds are necessary in small turbines. Thus a 150-b.h.p. engine must run at 40,000 r.p.m. at full power. However, in automotive work the speed of the compression turbine would normally be 50–80% of the maximum, and that of the power turbine 20–60% of maximum. At these rotations, bearing and gear design presents difficult problems.

Spill-control burners with orifices of *ca* 0·010 in. dia give good idling conditions, and are not so liable to blockage by particles in the fuel as burners of smaller orifice.

Tables and graphs are given for an engine of 160 b.h.p. without heat exchanger. They show that an optimum fuel consumption of 13 m.p.g. at 40 m.p.h. is achieved. The car is 25% lighter, and the acceleration 20% more, than that of a car with an equivalent reciprocating engine. In addition a gearbox is not required, and the power turbine can be stalled indefinitely without damage. Graphs are also given for the application of this unit to drive a bus of weight 20,000 lb, and the advantages of such an engine in such circumstances are pointed out. H. C. E.

513. Air and Oil Filtration. Anon. *Auto. Engr*, 1948, **39**, 12.—This note contains a table of the results of wear tests on an engine equipped with a Vokes air filter and a partial-flow oil filter.

Four trials were carried out: (1) without filters; (2) with air filter; (3) with air filter and partial-flow oil filter; (4) with air filter and full-flow oil filter.

It was found that, although the partial-flow filter removes considerably more solid matter from the lubricating oil, it does not protect the bearings to the same extent as the full flow filter. O. M.

514. Chrome Hardening of Liners. C. D. B. Williams. *Gas Oil Pwr*, 1948, **43**, 349–350.—Chromium is unaffected by almost all the corrosive products encountered in a heavy oil engine, but when chrome-plated cylinders are used, piston and ring seizures are frequent because oil will not adhere to the plated surface. This can be overcome by etching after plating, so that the microscopic cracks are widened and deepened, thus producing surfaces varying from the "channel type" to the "pitted type." The average depth of the porosity is 2–4 thousandths inch, and the thickness of the chromium must be greater than this. Honing of the cylinder bore takes place before and after plating, to remove the "high spots." H. C. E.

515. C.A.V. Injection Pump. Anon. *Auto. Engr*, 1948, **38**, 392.—In general lay-out the new "N"-type injection pump follows previous C.A.V. practice, but, despite the addition of a final filter, it has smaller dimensions allowing increase in stiffness of the camshaft. An important feature of the pump unit is its attached "H"-type hydraulic governor, which is an all-speed type, permitting the engine speed to be set at any desired speed between idling and maximum. O. M.

516. Research Work of B.I.C.E.R.A. Anon. *Gas Oil Pwr*, 1948, **43**, 367–368.—Work carried out during the year ending March 31, 1948 is summarized under the

following headings: fuel injection, fatigue of cast-iron crankshafts, performance of bearings, loaded-shaft effects, pressure-charging, torsional vibration, and gas generators. H. C. E.

517. Study of Engine Firing Orders. G. J. Dashefsky. *Gas Oil Pwr*, 1948, **43**, 316.—The influence on the dynamic balance of an engine of the firing sequence of cylinders can be examined by means of the Vectorscope, which can automatically add vector quantities with about the same accuracy as a graphical summation. Descriptions of the instrument and its method of use are given. The device will handle engines up to nine cylinders, and the investigation of ten cylinders is believed to be possible, although 181,440 firing orders are mathematically possible. An eleven-cylinder engine has too many firing orders for complete study, but the Vectorscope can select some of the better ones by trial and error. H. C. E.

MISCELLANEOUS.

518. Capital Formation in the Petroleum Industry. J. E. Pogue and F. G. Coqueron. *Petrol. Tech.*, Sept. 1948, **11** (5), *A.I.M.M.E. Pub. No.* 2431, 1–5.—Most of the capital required for the expansion of the petroleum industry is generated by its own operations. In the case of thirty U.S. companies the portion of the net income ploughed back has risen from about 43 to 65% between 1934 and 1947. In the 1945–47 period these companies borrowed $476 million, banks providing 63·2% of this total, and insurance companies 34·7%. Of the 1947 capital expenditures of the thirty companies, amounting to $2070 million, about 57% represented expenditures arising from the rise in construction costs above the 1939 level, and some technological changes such as deeper drilling. It is estimated that with 36° mid-Continent crude currently priced at $2·57/brl, 74 c represents the part of the price reflecting the rise in construction and technological costs above the 1939 level, while $1.83 results from other factors. G. D. H.

519. World Supply Picture Brightens but Problem not yet Solved Entirely. A. D. Stewart. *Oil Gas J.*, 30.12.48, **47** (35), 156.—A substantial improvement in the present world supply–demand situation is evident compared with a year ago, and is due to the industry's world-wide programme to increase producing, refining, transportation, and storage facilities.

It will be necessary to build up safe reserves, as the problem is not finally solved.

Tables and figures show world supply crude oil and allied products production (excluding Russian controlled sources), world demand, and growth in supply and demand 1938–53. G. A. C.

520. Foreign Production Shows Midyear Increase of 374,000 brl daily. W. W. Burns. *Oil Gas J.*, 29.7.48, **47** (13), 179.—Foreign crude-oil production, exclusive of Russia and the Baltic countries, reached just over 3 million b.d. for the first 6 months of 1948, a mid-year increase of over a third of a million b.d.

It is estimated that overall 1948 foreign average production, exclusive of Russia and Baltic countries, may average as high as 3,132,000 b.d., and this may be an under-estimation.

Tables show production by countries. G. A. C.

521. Foreign Production up 21·2%. D. M. Duff. *Oil Gas J.*, 30.12.48, **47** (35), 147.—A table shows world crude-oil production in thousands of brl for 1938, 1947, and 1948, with percentage increase of 1948 over 1938 and 1947.

Increase over 1947 was 21·2%. Exclusive of Russian-controlled countries total is now 3,363,100 b.d.; Russia is believed to be producing 600,000 b.d. G. A. C.

522. International Survey of Oil Refineries. Anon. *Oil Gas J.*, 30.12.48, **47** (35), 245.—A survey of the oil refineries of the world is given, showing number of refineries, location, type, crude, and cracking capacities. Official information on Russia is not available. Total world capacity of 653 refineries is given as about 10 million and 5 million b.d. crude and cracking capacity respectively. G. A. C.

523. World Refining Capacity is Rapidly Approaching 10,000,000 brl Daily. R. B. Tuttle. *Oil Gas J.*, 30.12.48, **47** (35), 236.—A summary is given of the estimated world refining capacity, past, present, and projected, by continents and countries. Years concerned are 1940, 1948, and 1949–50. Russian increase is not known.

G. A. C.

524. Cost-imating. Construction Cost Indexes. W. L. Nelson. *Oil Gas J.*, 21.10.48, **47** (25), 141.—No. 1 in a new series gives a chart showing approximate material and labour indices, relative to 1946 = 100, for refinery construction, overall construction costs, equipment, and labour for the years 1924–48. G. A. C.

525. Cost-imating. Use of Cost Indexes. W. L. Nelson. *Oil Gas J.*, 11.11.48, **47** (28), 387.—No. 4 in this series gives a table showing comparison of exchanger costs (150-lb steel tubes) converted for various years to 1946, and the accuracy of indices for conversions are discussed.

To allow for variation in construction costs in different parts of the U.S.A., indices for location are given. Two examples are provided and worked out. G. A. C.

526. Story of the Diesel. H. T. Hill. *Midwest Engr*, 1948, **1** (3), 3–7.—The history of the diesel engine in the U.S.A. is reviewed from 1898 to the present day. Present production is 10 million h.p. per year, and reasons are advanced to show that an increase may be expected in all sections of industry. The development of the diesel is assured by a big training programme for engineers. H. C. E.

527 Diesel Smoke Symposium. Anon. *Gas Oil Pwr*, 1948, **43**, 313–316.—This paper is a summary of six contributions to the S.A.E. in 1948. The following titles and abstracts are given:

Influence of Injection Characteristic on Exhaust Smoke (M. Berlyn);
Smoke in High-Speed Diesel Engines (J. J. Broeze and C. Stillbroer);
Rating Diesel Engines on Smoke Curve Basis (K. J. Fleck);
Technique of Exhaust Smoke Measurement (J. P. Jung and F. L. Coers). (See Abstract No. 1273 [1948].)
Operator's Viewpoint of Exhaust Smoke (A. S. Leonard).
Describes devices designed to prevent improper adjustments to fuel pumps.
Diesel Engine Exhaust Smoke as Influenced by Fuel Characteristics (H. D. Young).

In tests of twenty-six fuels for city-bus use, the following facts and trends became apparent in the elimination of noxious smokes: (1) the 50% point of a fuel must not exceed 475° F; (2) if the I.B.P. is high, the E.P. must be low, and *vice versa*; (3) for fuels of given I.B.P., exhaust smoke varies with tail-end volatility; (4) light diesel fuels are satisfactory as regards exhaust smoke and odour, but not for lachrymation; (5) Cetane No. is not important, but appears to have some bearing on odour during idling; fuels of Cetane No. >45 are satisfactory; (6) the addition of amyl nitrate improves exhaust odour, but increases lachrymation; (7) high jacket temperatures will decrease smoke and odour; (8) a method of estimating exhaust-smoke performance on the basis of the distillation curve is described. H. C. E.

528. Sinclair Research Laboratories. K. B. Barnes. *Oil Gas J.*, 21.10.48, **47** (25), 83.—The Sinclair Refining Co. have opened new large laboratories built on a 33-acre site at Harvey, Chicago, Ill.

There are main laboratory administration, engine-laboratory, lub-treating—compounding—distillation, pilot-plant, exploratory research, fuel-application laboratory buildings with shops, storehouse, and boiler-house combined in one building.

G. A. C.

529. New Esso Research Centre to Serve all Companies in Jersey Group. G. Weber. *Oil Gas J.*, 21.10.48, **47** (25), 80.—The Standard Oil Development Co.'s Esso Research Centre at Linden, N.J., is described. This latest and largest expansion provides facilities for over 600 technical investigators; much of the 270,000 sq. ft of floor space is laboratories.

Research projects include investigations into chemical synthesis, fluidized-solids technique, improvement in octane rating, and yield of gasoline. G. A. C.

530. Carbon pH and Structure in Rubber Compounding. H. A. Braendle, H. C. Steffen, and J. R. Sheppard. *India Rubber World*, 1948, **119** (1), 57.—Topics discussed are carbon pH, scorching, curing, carbon structure, and reinforcement. A fine-particle furnace carbon is competing with channel carbon as a rubber reinforcer. C. N. T.

531. New Approach to Process Steam. L. G. North-Croft. *Heating Ventilating Engr*, Nov. 1948, **22**, 211.—The popular concept of the function of steam is for power. Fundamentally, in process work, steam is used to heat water, liquids, or air. The lower the steam pressure, the greater the amount of latent heat per pound of steam, but the lower the steam pressure the lower the temperature, and therefore the less temperature gradient between the steam and material, the slower the heat flow. A temperature gradient is necessary to allow the heat to penetrate the several resistant films in the system.

It is shown that by proper plant design the thickness of the resistant films of air and condensate can be greatly reduced, and as a result the heat flow is increased.

Air is present in steam spaces partly because it is brought in with steam from the boiler in solution in the feed water. Feed water and feed-water treatment should be such as to ensure the minimum amount of air in solution.

To remove condensed water from the steam current a separator, which itself is properly drained, should be employed. Insulating distribution mains and flanges are important. The increase of velocity of the steam over a heated surface increases the rate of heat transfer.

The resistant film of condensate can be decreased by introducing promoters to induce dropwise condensation. Unfortunately, the promoters themselves are corrosive and would affect the boiler. The cleaning of scale from steam-condensing places is advisable. This may be effected by mechanical scraping or stirring. The stirring method is most efficient if the stirring gear is not run too fast.

The exhaust gases should be used to the full, and their final temperature brought down to a minimum. As much condensate as possible should be returned to the boiler, because soft water is admirable as boiler feed.

A Lancashire boiler generating steam at 200 p.s.i. with a reasonable amount of superheat as a by-product will give a useful supply of power. If the idea of steam for heating and any power extracted is a by-product, is kept in mind, the highest overall efficiency will be obtained. D. K.

532. Inhibited Hydrochloric Acid Has many Applications in the Petroleum Industry. G. F. Williams. *Oil Gas J.*, 25.11.48, **47** (30), 98.—The removal of scale from heat-exchanger tubes, engine water-cooling jackets, and well equipment by means of hydrochloric is described.

The circulation of a 15% inhibited hydrochloric-acid solution through the cooling system of an engine is a simple method of removing scale. A suitable pump draws the acid from a drum, and circulation is maintained until the scale is dissolved, or until concentration of acid remaining constant shows that the soluble part of the deposit has been removed.

Oil-treating heaters, flow lines, valves, and pipe fittings can also be treated with inhibited hydrochloric acid, as also may heat exchangers, boilers, and other refinery equipment.

Introduction of acid in well casing will remove scale build up. G. A. C.

533. Handling Sulphuric Acid Sludges. E. L. Hildebrand. *Oil Gas J.*, 30.9.48, **47** (22), 68–69, 90.—Major problems in the chemical treatment of oils by sulphuric acid are encountered in the auxiliary equipment necessary for acid separation, reclaiming, reconcentration, and disposal of by-products, since diluted sulphuric acid is very corrosive to steel.

As a result of acid treatment of petroleum, an acid sludge is formed which settles from the oil and is separated; the acid is recovered, and the sludge used as boiler fuel. In these processes most trouble is given by valves, pipe, and pumps. For pipes, methods employed are: (1) reducing temperature of weak acid; (2) use of materials such as lead, glass, ceramics, tantalum; (3) combinations of above materials, such as bonded lead pipes with Karbate sleeves. In service, method (3) is the only one which

is at all practicable. For valves the most satisfactory material is Monel-trimmed brass, while aluminium bronze and pressed Monel give good results for pumps.

Boilers which burn sludge do not corrode during operation, but effects of sludge are seen in rapid corrosion during inspection and repair periods. This can be counteracted by washing down the boilers as quickly as possible after coming off the line, and neutralizing with soda ash. W. M. H.

534. High-Lights of Present Day Russian Chemical Research. J. G. Tolpin. *Chem. Eng. News*, 1948, **26**, 3096–3140, 3170.—A survey of current Russian chemical research is made, and a bibliography of 211 literature references given. The broad topics reviewed are on oil production and refining, petroleum chemistry, aromatic hydrocarbons, acetylene derivatives, high polymers, organo-silicon compounds, alkylation, hydrogenation, dehydrogenation, dehydrocyclization, chlorination of hydrocarbons, isomerization, oxidation and combustion of hydrocarbons, synthesis of individual hydrocarbons, chemistry of lubrication, petroleum substitutes, uses of peat, terpenes, high-pressure research, molecular structure and chemical kinetics, and catalysts. E. S. E.

BOOKS RECEIVED.

Summary of Investigations on New Brunswick Oil Shales. Mines and Geology Branch. Canadian Dept. of Mines & Resources. *Canad. Dept. Mines Res.*, Bull. 825, 1948, pp. 24.

Due to shortage of petroleum products in Canada the possibility of developing the oil shales of New Brunswick was explored in 1942. Seventy-nine boreholes varying from 99 to 1004 ft in depth were sunk, and assays were made on more than 3000 cores taken in 5-ft sections. The general conclusion is that no major addition to the oil resources of Canada has been brought to light. Reports on specific areas are given as follows :—

Rosevale.—The number of boreholes was thirty-six, and 818 samples, together with thirty-six samples from outcrops and tunnels, were analysed. S. C. Ells reports that the production of petroleum from oil shales in this area is not economically feasible.

Taylor Village.—As a result of twenty-four assays F. J. Alcock reports that the average oil content over the whole area is about 6 gal and is too low for the shales to be of commercial importance.

Albert Mines Area.—From the thirty-six holes in this area 2384 core samples were taken. In the opinion of F. J. Alcock, if a large tonnage of material to be mixed by open-cut is wanted it will be necessary to treat shales of 10- to 12-gal grade. About 2 million tons of around 20 gal per ton is present, but most would have to be secured by selective mining. Some 20 million tons of 12-gal material could be obtained by open-cut, and a block with vertical walls contains 100 million tons of 10·6-gal material.

Analytical methods and results are described by A. A. Swinnerton. G. S.

1948 Supplement to Book of A.S.T.M. Standards. Part I-B. Non-Ferrous Metals. Pp. 291–x. **Part II. Nonmetallic Materials—Constructional.** Pp. 280 + xv. Philadelphia, Pa. : American Society for Testing Materials, 1948.

Report of the Geological Survey Board for the Year 1947. London : H.M. Stationery Office, 1948. Pp. 17.

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Oilfield Exploration and Exploitation.

Geology.

535. Aerial Photography and Exploration for Oil. N. J. M. Taverne. *J. Inst. Petrol.*, 1948, **34**, 516–535.—A short summary of the historical development of air mapping and a review of the principles of photogrammetry of particular interest to the interpreter of aerial photographs are presented. Some important methods and applications of photography from the air in exploration for oil are discussed. A. R. W. B.

536. Oscillation Chart. M. C. Israelsky. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 92–98.—The author presents a chart based on the foraminiferal content of shaker samples from 6000 to 11,760 ft derived from a well in the Lirette field, Louisiana. It is suggested that the chart shows relative changes in depth of water at this geographical position during Miocene times. The possible uses and limitations of this technique of chart production are discussed. E. N. T.

537. Sampling and Examination of Well Cuttings. J. M. Hills. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 73–91.—The examination of well-cutting samples provides one of the chief sources of information concerning the subsurface, and this is particularly true in the Mid-Continent and Permian basin areas of the United States. The techniques described in this paper are not novel but provide a useful summary of available experience. By carefully applying the methods of collecting and preparing these samples as described, it is possible to obtain cutting samples which are truly representative of the formations penetrated. By microscopic examination of these samples, descriptions and plotted logs can be made which give an accurate stratigraphic and structural picture of the subsurface.

Illustrations are given of how detailed descriptions of cutting samples from pay sections can be used in making estimates of oil and gas recovery from a field and in reservoir studies. E. N. T.

538. Fractured Reservoirs of Santa Maria District, California. L. J. Regan and A. W. Hughes. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 32–51.—The total oil produced from the Santa Maria district of California up to January 1, 1947, was 250,637,000 brl, of which 77 % was from fractured rocks and the remainder from oil sands. 74½% of the oil was produced from fractured rocks in the Monterey formation, and 2% from fractured Knoxville sandstones. Monterey fractured rocks include Mohnian cherts, Luisian calcareous shale, and Mohnian platy siliceous shale. The author describes the distribution, age, and characteristics of these formations by a series of stratigraphic sections. The general characteristics of the potentially productive fractured rocks are discussed. E. N. T.

539. Lyons Sandstone of Colorado Front Range. O. Thompson. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 52–72.—The Permian Lyons sandstone of the Front Range was first described in 1905. The present paper describes the unique original structures in detail, and a chart and several illustrations show the salient aspects of the formation.

The paper is primarily a study in sedimentation. Features such as cross-stratification, lamination, and rhomboid ripple marks are compared with similar features of modern beaches. It is concluded that the Lyons sandstone is an ancient littoral deposit in which both shore and æolian processes are discerned. A further conclusion is that the Lyons is Middle Permian in age, approximately equivalent to the Leonard formation of West Texas. E. N. T.

540. Deep Oil Possibilities in Illinois. L. E. Workman and A. H. Bell. *World Oil*, Dec. 1948, **128** (8), 128.—During the past four years sixteen wells have been drilled in Illinois to test the St Peter or older rocks. Of these thirteen have gone below the St Peter, and two reached basement. None of them found oil. It is estimated that there are 2000–4000 ft of Palæozoic sediments below the St Peter in Illinois. Conditions do not seem to be favourable for oil in the St Peter and older beds in the northern third of Illinois; the rest has not been adequately tested. The St Peter has been found dry on a number of prominent structures. Older formations have shown good porosity, but there are no authenticated oil shows.

Nearly all the Illinois fields are in the southern half of the State. About 75% of the oil has come from the Mississippian, 20% from the Pennsylvanian, 4% from the Devonian, and 1% from the Silurian and Devonian.

Two stratum contour maps show the form of the basement and the structure of the St Peter. G. D. H.

541. Beckenham County, Oklahoma Tests Raise Questions. Anon. *Oil Gas J.*, 11.11.48, **47** (28), 405.—Union Producing Co. 1 Music in N/2 SE NW 25-10n-21w, in the Elk City area, has given 15 million cu. ft/day with distillate in a drillstem test at 9637–9666 ft. Similar results were obtained down to 9694 ft, apparently from granite wash. This well is 2 miles south and a little east of the discovery. 1 mile west of the discovery a well has flowed 46° oil at 550 b.d. from 9016–9100 ft. The pay is limy, and is believed to be Pennsylvanian. The area is on the northeast flank of the Wichita uplift. It is known that there is a great mass of ill-sorted sediments with the possibility that accumulations may be erratic in occurrence. G. D. H.

542. East Side of Permian Basin Draws Attention. Anon. *Oil Gas J.*, 18.11.48, **47** (29), 145.—The Permian basin of Texas now gives nearly 800,000 b.d. On the west side the pre-Permian play is developing and extending into new Mexico. In northwest Scurry county two Canyon lime strikes have been made. Both indicate reef developments at depths of more than 6000 ft. In the Jameson area of Coke county a Strawn sand pay has given 7 brl/hr, and is 1 mile southeast of the nearest Strawn crinoidal reef lime producer. G. D. H.

543. Search for Oil in Ontario. Z. P. Trotter. *World Oil*, Dec. 1948, **128** (8), 227.—In February 1946 the Becher oilfield was opened near Wallaceburg, producing from the Guelph and Salina at about 1850 ft. In August 1947 gas was found in the Kimball area, 12 miles southeast of Sarnia.

Oil Springs was opened in 1861, Petrolia in 1865, and Bothwell in 1862. Petrolia has produced 15 million brl, Oil Springs about 8 million brl, and Bothwell 3,400,000 brl. Together with a number of smaller fields they produce from the Devonian at depths of 350–450 ft. Dover has produced oil and gas from the Trenton at 3000–4000 ft, and Mersea has given about 500,000 brl from a depth of 1000 ft.

Ontario has produced 385,000 million cu. ft of gas from 18,000 wells. G. D. H.

544. Stratigraphy of Southeastern Turkey. C. E. Tasman. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 22–31.—In southeastern Turkey there are more than 2000 m of Cambro–Ordovician strata composed largely of micaceous sandstones, siliceous limestones and pyroclastics, limestones and marly limestones.

The Permian underlies the Triassic without an unconformity. The Mesozoic

section is principally calcareous as high as the Middle Cretaceous. The Upper Cretaceous is composed principally of argillaceous shales.

The lower part of the Eocene is arenaceous, but the Lutetian is an extensively developed thick limestone. The Miocene is represented by siliceous and gypsiferous limestones and shales. The extensive development of the Pliocene in the continental facies suggests similarity to the Bakhtiari series of Iran. E. N. T.

545. Syrian Petroleum Abandons Wildcat in Aleppo Area. Anon. *World Oil*, Dec. 1948, **128** (8), 238.—Bafloun 1, 30 miles northwest of Aleppo, has been abandoned at 8666 ft, in steep Palæozoic beds after penetrating the Mesozoic without finding oil or gas. G. D. H.

546. Digboi Oil Field, Assam. E. V. Corps. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1–21.—The structure of the Digboi oilfield in northeastern Assam is a faulted anticline. The three main producing formations are the Bappapung sandstone, the Nahor oil sand, and the members of the Digboi oil-sand group. There is pronounced lateral variation, and permeabilities are very low. As a result, productivity is very variable, and it has been necessary to use very close spacing. The oil is remarkable for its high pour point (95° F) and high wax content. The author discusses a number of geological, drilling, and production problems. E. N. T.

Geophysics and Geochemical Prospecting.

547. Geophysical Exploration. R. D. Wyckoff. *Oil Gas J.*, 11.11.48, **47** (28), 343.—Magnetic and gravity surveys can cover large areas at reasonably low cost and so are of value in reconnaissance, *i.e.*, in order to determine regional geological features. In early days magnetic surveys were often misapplied and badly interpreted, with consequent drilling failures. By careful study of regional magnetic data the basement depth can be estimated with a fair degree of accuracy. The basement is the main source of the effects measured.

The gravity survey takes note of basement and sedimentary effects. Gravity-meter sensitivity is already greater than surveying and other errors, and thus portability and ease of manipulation are the features now sought. Under-water gravity-meters have been developed. On land about two-thirds of the cost is attributable to surveying.

Both gravity and magnetic surveys do not provide data capable only of a unique interpretation. Seismic methods are better in this respect. Both refraction and reflection techniques are now being used for detailing. In offshore work radio techniques have proved valuable in the surveying phase; shoran, loran, and radar have been employed, in addition to phase-comparison systems. In under-water work improvements have been made with regard to shot troubles arising from bubble effects. There have been innovations with regard to detector set-up in order to cope with various types of bottom conditions; geophones have been suspended or incorporated in cables. G. D. H.

548. New Method of Seismic Exploration for Oil. Anon. *World Petrol.*, Dec. 1948, **19** (13), 52.—In this method small, specially shaped charges are set on stakes close to the ground in a hexagonal pattern of 7, 13, or 19 points, with one in the middle. Charges are spaced from 5 to 85 ft apart and detonated simultaneously. In this method detonation at or above the ground sets up a high intensity wave, but since the medium (air) is elastic, little absorption occurs. (In a bore-hole much of the energy is absorbed within a few ft of the charge.) This energy is applied over a relatively large area of the earth's surface so that absorption on entering the earth is reduced. With normal wave-forms intensity decreases at a rate inversely $\propto$ to the square of the distance from the source. If the wave front is flat there is no decrease in intensity with distance. To produce such a wave front, a modification of the " shaped charge " method was found to be effective. A flat, circular charge detonated from the centre will also produce an essentially flat wave front. At a demonstration it was shown that for best results a cylindrical charge length six to eight times the diameter, detonated from the top, was necessary. Good reflections have been obtained by this method in an area where no usable records were obtained by the shot-hole method. C. G. W.

549. Plastic Tubes for Preserving Cores. W. Sawdon. *Petrol. Engr*, Dec. 1948, **20** (3), 139.—Transparent tubes of plastic are being used for storing and transporting cores. The tubes are closed by a tight-fitting cap sealed with a solvent. Advantages are: (1) possibilities of mixing in reversing cores are eliminated, since the cores are tagged before sealing, and the tubes must be cut to remove or tamper with the core; (2) cores are not subject to weathering contamination or loss of volatile or fusible material. C. G. W.

Drilling.

550. Corrosion Inhibition with Chromate. 2. Drilling, Oil Production and Gas Condensate. M. Darrin. *Oil Gas J.*, 20.1.49, **47** (38), 87.—In drilling the major problem is to avoid corrosion fatigue. This is effected by reducing mechanical stresses and avoiding any conditions likely to cause strains or vibration in any part of the drill string, and by adding a corrosion inhibitor to the drilling fluid. Chromates and bichromates are the only effective inhibitors. Concentrations from 2000 to 5000 p.p.m. are used. In the case of bichromate the pH of mud must be raised and soda ash is usually used. Practices employed are mentioned. Frequency of twist-offs has been much reduced due to both inhibition and improved techniques. Corrosion in condensate wells is often severe; the cause for this is controversial. Corrosive attack may be expected in wells deeper than 5000 ft, reservoir temperature $>160°$ F pressure >1500 p.s.i., particularly with CO_2 concentrations in excess of 0·2% by volume. Corrosion is combated by injecting bichromate through the casing-head annulus. In some fields when using chromate deposits may occur in tubing. No satisfactory method has been evolved for its removal. Work is proceeding on organic and inorganic inhibitors, such as napthenic acids, soda ash, etc., but results have not been satisfactory.

Where it is not possible to inject solutions through the casing head, cast sticks or pellets containing chromate may be dropped into the well, or solutions injected through macaroni tubing. An account is given of results obtained under a number of conditions, results being outstanding in fourteen out of thirty-three cases. At present about 200 wells are being treated with various types of inhibitors, but results are not available. References are appended. C. G. W.

551. Offshore Drilling Expenditure. L. S. McCaslin, Jr. *Oil Gas J.*, 23.12.48, **47** (34), 50.—Expenditure on a typical offshore drilling programme is analysed item by item. Major items are: transport fleet, \$426,000; drilling equipment, \$335,000; platform and barge, \$470,000; and lease, \$150,000. C. G. W.

552. Self-contained Power Barge. R. F. Carlson. *Oil Gas J.*, 20.1.49 **47** (38), 80.—A barge designed for operation on Lake Maracaibo, Venezuela, may enable drilling operations to be carried to 15,000 ft. The diesel–electric barge houses all equipment except draw-works, draw-works motor, and rotary equipment. Prime movers are diesels of constant-speed slow rotation. Three of these each develop 750 h.p. at 360 r.p.m. and are connected to three 400-kW, 395-volt variable-voltage D.C. generators. Auxiliary generators and an exciter are also coupled to each engine. C. G. W.

553. L.S.T. Conversion. L. S. McCaslin, Jr. *Oil Gas J.*, 25.11.48, **47** (30), 82.—Navy surplus Landing Ships (Tank) are now being converted for offshore drilling purposes in the Gulf of Mexico. These 327-ft vessels, designed for transporting men and materials, were purchased for \$75,000 and conversion costs approx \$600,000 each. Conversion entails removal of gun emplacements and welding of low doors. The hatch is enlarged, and a 35-ton revolving crane installed forward of the hatch. 5-ton cargo booms are placed aft, and six 50-ton winches placed on deck to moor the L.S.T. Four of the ballast tanks are used for drilling mud. About 600 brl can be circulated, and the same amount held in reserve. Two 500-h.p. diesel-powered mud-pumps are controlled by air from the drilling platform. Complete cementing equipment is permanently installed in the extreme bottom of the ship. On the third deck level equipment and materials are stored. Quarters for personnel, water-system, and intercommunication systems must be provided.

Capacity of the ships is 3400 tons of equipment and fifty-nine men. The ships are not self-propelled and are towed to location. C. G. W.

554. Completions with Mud Acid. E. F. Kelly. *Oil Gas J.*, 6.1.49, **47** (36), 62.—Failures in cementing jobs are believed to be mainly due to the filter cake on the wall of the hole. Failure may be due to: (1) contamination of mud by cement; (2) prevention of a bond between the cement and formation; (3) prevention of loss of water to the formation.

The principle of squeeze cementing is that pressure is applied to the slurry squeezing water from the slurry into the formation. This is impossible with an impervious sheath on the wall of the hole. Mud acid, a hydrochloric-acid solution containing inhibitors, surface-tension reducing agents, and emulsion breakers, has been effectively used to remove the mud sheath from the hole wall. C. G. W.

555. Measurement of Mud Viscosities at High Temperatures. V. N. Bednarski. *Petrol. Engr*, Oct. 1948, **20** (1), 192.—The increasing depth of wells with consequent higher temp makes it desirable to study the effect of high temps on mud viscosities. The instrument used was a torsion-type viscometer similar in general construction to an early Garrison viscometer. Rotating-cup speeds are controlled by selective gear reduction and variable speed motor and registered by a stroboscopic disc on the driving motor. Problems in operation are heating to and maintaining the required temp, and preventing evaporation of water from the sample. A thermostatted bath and an ordinary mercury seal proved ineffective. The final design consisted of an aluminium cover with four cartridge heaters and four thermostats set to the desired readings. The mercury seal was maintained at the same temp as the sample, and this suppressed the leak of water. The instrument was calibrated by a series of secondary oils whose viscosities were determined by Ostwald viscometers. The stability of operation as shown by the viscosity curve which after initial fluctuation remains constant for 3½ hr. Temp–viscosity effects for a number of clays are presented for temp up to 200° F at atmospheric pressure. Results indicate that most muds develop an increase in viscosity above 160° F at rates of shear of less than 600 r.p.m. C. G. W.

556. Electrical Features of Shell's Portable Rig. E. H. Hulse. *Oil Gas J.*, 13.1.49, **47** (37), 58.—Details of the electrical system of Shell's new portable rig are described. Flexibility of operation is achieved by an interconnexion scheme making possible multiple combinations of generators and motors, and the concentration of control of normal operations at the driller's station. C. G. W.

557. Large Steam Rig as Deep Drilling Laboratory. K. M. Fagim. *Petrol. Engr*, Dec. 1948, **20** (3), 115.—A heavy-duty steam drilling rig is being used to determine how to increase the safety and efficiency and reduce the costs of deep drilling operations. Automatic and remote controls are used extensively. Improvements in rate of penetration, life of bits, and drilling mud control are major objects of the project. Automatic devices used on the rig are described. C. G. W.

Production.

558. Economics of Cycling. M. G. Arthur. *Petrol. Engr*, Oct. 1948, **20** (1), 142.—Pressure maintenance may be applied to black-oil reservoirs, *i.e.*, where part of the hydrocarbon is initially in the liquid phase or to condensate fields where the mixture is initially entirely in the gas phase and exhibits retrograde condensation. Advantages of pressure maintenance in black-oil reservoirs are: (1) prevention of increase in oil viscosity, facilitating flow. This is not true over the entire pressure range. (2) prevention of shrinkage of reservoir oil; (3) better control of edgwater encroachment and superior flooding efficiency due to reduced viscosity of oil; (4) prevention of encroachment of black oil into gas cap; (5) maintenance of higher production rates. Other factors are extension of the flowing life of field, reduced development costs, and possible reduced secondary recovery costs. Recovery and profit factors for pressure maintenance are tabulated.

Cycling of condensate reservoirs is described by evaluation of a hypothetical case. Procedure was: (1) for given rate of flow with no condensate accumulation the pressure gradient is determined; (2) amount and distribution of condensate accumulated during flow of a given quantity at this gradient is determined from phase be-

haviour; (3) available relative permeability data and the above liquid saturation distribution gives a new pressure gradient, and the process is repeated. The decline of productivity indices, notes of gas injection and recovery pressures, drops in tubing recoveries, size of gas plant, and economic factors are evaluated. These factors are then applied to three methods of operation: (1) cycling and depletion; (2) depletion cycling and again depletion; (3) depletion followed by cycling.

An exhaustive analysis is given of this hypothetical case, and the data are expressed graphically. It is concluded that profitable operation depends on many factors and that it is not possible to generalize. Some major factors are: (1) field characteristics such as occurrence of black oil, reserves, properties, and composition of product; productivity; permeability variation; extent of natural water drive and field and plant costs; (2) demand; (3) future value of products; (4) rate of interest; (5) competition; (6) taxation.

An extensive bibliography is appended. C. G. W.

559. Selection of Sucker Rod Pumps. K. N. Mills. *Petrol. Engr*, Dec. 1948, **20** (3), 142.—It is important to use the smallest practical pump, otherwise the well load is increased, necessitating larger sucker rods and surface pumping machinery. In determining pump size, the surface stroke length should be maximum possible and the pumping speed relatively slow. The two classes of sucker-rod pumps are: (1) tubing pump—pump barrel on lower end of tubing, plunger on sucker rods; (2) rod pumps. The entire assembly is lowered on rods, the barrel seating in the tubing.

Three types of rod pumps are available: (*a*) stationary barrel with top hold down useful for producing gassy or sandy fluids; (*b*) stationary barrel with bottom hold down useful for deep wells producing sand-free fluid; (*c*) travelling barrel type—well suited to wells producing sandy fluid pumped intermittently. Mechanical hold-down pumps are preferable to cup-type, since the force required to insert the latter may cause overstressing of sucker-rods.

Cup- and ring-type plungers cause greater friction losses than metallic plungers.

Multiple valves: the possibility of valves cutting out is greatly decreased, but in the standing valve location have the disadvantage of increasing the resistance to flow on the suction side. C. G. W.

560. Sand Face Cleaning with Lye, Aluminium and Oil. F. R. Cozzens. *World Oil*, Aug. 1948, **128** (4), 174.—In cleaning stripper wells, all effects must be accomplished from within the hole. Three objectives are to be considered: to break down and dissolve the waxes and the structures holding waxes to the sand face, and to cause sufficient scaling of the sand face to remove plugging materials from behind it. It is usual to employ some chemical reaction to maintain a temp of about 170° F in the hole for some period of time. A method widely approved is a combination of caustic soda–metallic aluminium supplemented with crude oil. Procedure is to bail the hole as dry as possible, add the required fresh water followed by the calculated quantity of lye. The lye is washed down with one half the necessary crude oil, aluminium pellets added and washed down with the remaining oil. The temp must be maintained for 6–8 hr, and temp readings are taken at intervals. If a temp decline occurs, part of the solution is bailed out and replaced with fresh solution. After treatment the hole is emptied when the temp is about 80° F before sludges settle out. After bailing, the hole should be washed several times with gasoline-treated oil, left open for 10–12 hr., and again washed with oil before making ready for pumping. C. G. W.

Oilfield Development.

561. 59·1% of World Reserves Held by U.S. Firms. L. J. Logan. *World Oil*, Dec. 1948, **128** (8), 37.—At the beginning of 1948 proved world oil reserves were estimated to be 64,937,010,000 brl, 24,741,660,000 brl being in the U.S.A. U.S. domestic reserves and the foreign reserves of U.S. Companies total 38,365,910,000 brl. The Anglo-Iranian Oil Co.'s reserves are placed at 9,188,450,000 brl, and those of the Royal Dutch-Shell group, exclusive of the Shell Union of U.S.A., are estimated at 4,387,250,000 brl. The Shell Union reserves may be 800 million brl.

Reserves controlled by the Soviet Government in Europe and Asia amount to 7590 million brl, while the Mexican Government has 1058 million brl of reserves.

Standard Oil Company (N.J.) controls 8,950,125,000 brl of reserves.

Tables give world reserves and their distribution amongst nations and leading oil companies. G. D. H.

562. Report on the Long-Term Availability of Petroleum. Anon. *Oil Gas J.*, 18.11.48, **47** (29), 70.—The report is presented by the A.P.I. Its main conclusions are: (1) total availability of petroleum and petroleum products for consumption in the U.S.A. will increase from 1949 to 1958; (2) the average daily production in brl, of crude petroleum and natural-gas liquids in the U.S.A. will rise from 6,210,000 in 1949 to 6,960,000 in 1953; (3) availability of synthetic petroleum in the U.S.A. in the next five years is likely to be small, though large quantities of raw materials are procurable; (4) production of foreign petroleum is estimated to increase substantially in the next five years; (5) for the period 1954–58 it is not yet possible to estimate accurately the natural liquid hydrocarbons position in the U.S.A., but there should be no significant decline in availability from 1953 onwards; (6) reserves of natural gas are at a high ratio to consumption, and large quantities will be available to supplement liquid petroleum products. W. M. H.

563. Can California Step Up to 1,000,000 Brl Per Day, and Hold for Five Years or More? C. P. Watson. *Oil Gas J.*, 18.11.48, **47** (29), 73.—California oil industry in 1941 produced about 630,000 b.d.; in August 1945 average daily production was 941,000 brl, and it has now risen to 951,000 b.d. Factors causing this increase are: (1) continuing military demands; (2) increased industrial demands; (3) increased domestic use due to migration into California; (4) increased use of gasoline by "vacation starved" Californians.

The demand has been met by reconditioning and cleaning existing wells; putting idle wells on production; drilling extensions of oil fields; use of improved pumping equipment; and development of improved production technique. W. M. H.

564. More than 53 Million Acres of Canada's Prairie Provinces under Reservation. N. Williams. *Oil Gas J.*, 11.11.48, **47** (28), 209.—Alberta is the main site of activity, but northeast British Columbia, Saskatchewan and southern Manitoba are also involved. 43 million acres are leased or reserved in Alberta and 6 million acres in Saskatchewan. Over sixty-five geophysical crews are operating in this area, and a dozen light rigs are doing core and structure drilling. Eighty drilling rigs are active, mainly in Alberta.

Daily production was 18,100 brl early in 1947, but is now about 40,000—10,000 brl above the 1942 peak at the height of Turner Valley development. The region uses 60,000–65,000 b.d. of oil. In the first nine months of 1948 Alberta is estimated to have produced 7,668,697 brl and Saskatchewan 645,957 brl. Leduc–Woodbend now gives over 18,000 b.d. This field is not yet fully defined, and in many instances wells are severely restricted in output. The Redwater structure is believed to be larger than Leduc–Woodbend. Its discovery well gave 1700 b.d. from the Devonian D3 zone. Lloydminster produces from Lower Cretaceous sands.

A table summarizes data on the salient features of the Alberta and Saskatchewan fields. G. D. H.

565. Modern Methods Feature Peru's Oldest Operation. Anon. *World Oil*, Dec. 1948, **128** (8), 213.—Commercial production of oil has been obtained on the La Brea-Parinas estate since about 1830, and the Incas may have used seepage oil centuries before. Some 3800 wells have been drilled, and production obtained at depths ranging from 60 to 6500 ft. Production is about 28,000 b.d. and is obtained from stripper wells averaging at times ½ b.d. each, as well as flowing wells which may give several hundred b.d. Faulting is very complex. Production is from the Eocene, which has five main sandstone zones separated by thick shales. Pleistocene beds rest on the Eocene, and the latter is underlain by Cretaceous consisting mainly of marine shales. The primary cause of the accumulations is the presence of a major basement uplift extending west from the Andes.

Gas is carefully conserved, and that not used for fuel is injected into suitable parts of the producing structures. Experiments on water-flooding are being carried out. G. D. H.

566. Venezuela Production at New High. A. N. Sutton. *World Petrol.*, 1949, **20** (1), 36–41.—A detailed analysis is made of the increased and total production of crude oil in the Venezuelan fields during 1948. Out of a total of 492,546,000 brl (partly estimated), the West Venezuela fields contributed 351,690,000. E. B.

567. Venezuela May Have Big New Field in Tucupido. Anon. *Oil Gas J.*, 30.9.48, **47** (22), 55.—Eight wells have been completed at Tucupido, and they yield over 5000 b.d. of 39·6° crude. Two producing wells have been completed at Pelayo, 120 miles to the east, while at Socorro, a well drilled some years ago gave 644 b.d. of 28° oil. G. D. H.

568. Middle East Production Makes Sharp New Gains. Anon. *World Oil*, Dec. 1948, **128** (8), 236.—In September Saudi Arabia averaged 441,101 b.d., and Kuwait 160,266 b.d. Iran's output was 559,326 b.d., and Iraq's 36,516 b.d.

At the end of September Venezuela was producing over 1,360,000 b.d. G. D. H.

Transport and Storage.

569. 1948 and Future Major Pipeline Projects Total about 50,000 Miles. P. Reed. *Oil Gas J.*, 27.1.49, **47** (39), 213.—Major U.S.A. and foreign crude oil, products, and natural-gas line projects are tabulated, giving operating company, mileage, diameter, status, and contractor. G. A. C.

570. Costs of Transportation of Liquid Media in Long Pipelines. W. J. Walker. *Mech. World*, 1949, **125**, 65–67.—Cost variables are incorporated into an analysis of the various factors, and expressions are derived for the pumping cost and cost involved in pipeline installation. An interest rate of 5% is assumed. A graph shows the relation between the mean working pressure in the line and the constants B and k in the expression $C = BD^k$, where C is the cost (shillings) per ft of pipe and D is the pipe dia. An example calculated for gasoline transportation, indicates that the percentage distribution of annual costs is power 17, station 22, pipeline 61. V. B.

571. Pipeline Corrosion by Sour Crude Oil. L. R. Sheppard. *Oil Gas J.*, 11.11.48, **47** (28), 298.—Four main mechanisms by which hydrogen sulphide from sour crude oil attacks steel pipelines include direct chemical combination, oxidation of hydrogen sulphide to sulphur followed by chemical combination of iron and sulphur, formation of galvanic cells, and creation of hydrogen-sulphide concentration cells which accelerate chemical combination.

Corrosion may be detected by methods which include analysis of oil and brine for corrosion products, measurement of wall thickness, and visual inspection. Hydrogen formation is another and insiduous cause of line failure.

Elimination of water from sour-crude systems will remove dissolved hydrogen sulphide, but concentrations in the oil as low as 0·1%-wt. will cause rapid corrosion.

Rapid pumping rates and emulsification of the free brine with the oil are among methods suggested for reduction of corrosion. G. A. C.

572. Utilization of Electrically Insulated Couplings in Corrosion Control. W. F. Levert. *Corrosion*, 1948, **4** (1), 24–28.—The value of electrically isolating large or small sections of transmission, gathering, or distribution systems from connected metallic structures in order to carry out coating-resistance tests, apply cathodic protection, or break up long line currents is discussed. Tests are described of recently developed materials and methods for the installation of electrically insulated couplings for the insulation of pipelines. J. G. H.

573. Mechanical Design Features of Insulated Couplings. P. Williams. *Corrosion*, 1948, **4** (1), 29–31.—General design requirements for insulated couplings in the way of safety, durability, adaptability, and low cost are discussed, and a schedule of dimensions and tolerances for sleeves and washers is included. J. G. H.

574. Cost-imating Pipe Insulation. W. L. Nelson. *Oil Gas J.*, 27.1.49, **47** (39), 351.—No. 15 in this series gives tables showing recommended thicknesses of outside piping insulation for temp from below 200° to 1200° F, standard magnesia pipe covering, and costs of installed pipe covering per linear foot and in a bound-foot basis.
G. A, C.

575. Cost-imating. Insulation for Cold-1. W. L. Nelson. *Oil Gas J.*, 3.2.49, **47** (40), 91.—No. 16 in this series gives tables showing recommended kind and thicknesses of cork insulation, approximate prices of standard corkboard or lagging and sectional cork pipe covering based on 1946 costs. G. A. C.

576. Cost-imating. Insulation for Cold-2. Cork Covers for Fittings. W. L. Nelson. *Oil. Gas J.*, 10.2.49, **47** (41), 107.—Tables give approximate cost in dollars, at 1946 valuations, of: (1) Brine Thickness moulded covers for screwed fittings of various types, pipe sizes ¼–6 in; (2) moulded cork covers for flanged fittings, under designations Brine Thickness and Special Thickness, Brine, pipe sizes ¼–6 in. A third table gives installation costs of pipe or fitting covers percentage of material cost for thickness designations Ice Water Thickness, Brine Thickness, and Special Thickness Brine.
W. M. H.

577. Offshore Gas Pipeline. P. Reed. *Oil Gas J.*, 4.11.48, **47** (27), 96.—The line consists of 13 miles of 8⅝-in line for transmitting natural gas from Matagorder Bay to Calhoun County, Texas. Construction procedure is to truck 40-ft joints of coated and wrapped pipe to the launching point to be welded in 1000-ft sections. 1000-ft sections are welded into 5000-ft sections on the launching ways, and 1100 lb river clamps spaced at three per 1000 ft. Pontoons (55-gal drums) are spaced at 40-ft intervals with four at each river clamp. The 5000-ft sections are towed into position, and welding done by raising the pipe ends out of the water by means of an outrigger at the stern, and the boom of a dragline at the bow of an L.S.T. boat. Cathodic corrosion protection is given by two magnesium-anode installations. A central control and measurement station will be set on a platform above normal water level. The text is illustrated with photographs. C. G. W.

578. Instability in Pipe Flow. R. B. Whittington and E. W. S. Ashton. *Nature*, 1948, **162**, 997.—Theoretical considerations show that, in the flow of liquid through a cylindrical pipe, a " point of instability " is set up which approaches the pipe entrance as the Reynolds number (R) is increased. With flow at constant R the " point of instability " is fixed, and if disturbances arrive at this point the flow should become turbulent. If the disturbances have died away before they reach this point, laminar flow should persist. H. C. E.

579. Allowance for Losses Due to Exit, Entrance, and Fittings for a Gas Flowing in a Pipe Under High Pressure Drag. E. S. L. Beale and P. Docksey. *J. Inst. Petrol.*, 1948, **34**, 602–609.—The application of these corrections is considered, especially for the case of flow through a pipe connecting two large vessels where only the overall pressure difference is known. Equations are derived for calculating these losses in terms of velocity heads. A. R. W. B.

580. Continuous Film Records Right of Way. A. Gibbon. *World Oil*, Sept. 1948, **128** (5), 178.—Pipeline right of ways may be photographed from air on a continuous strip of film using a shutterless camera. Projection on to a screen provides a photographic record of the system and enables any section which needs attention to be checked from the screen. The camera is 6 in × 10 in × 10 in, weighs 50 lb, and is suspended on gimbal rings maintained level by a gyroscope. A synchronizing device enables the operator to vary the speed of the film to prevent distortion or blurring. Detail is clearly discernible on the film taken at a height of about 200 ft. Sections of films are shown. Flight technique and economic considerations are discussed.
C. G. W.

581. Compressor Cylinder Clearance. W. R. Barrett. *Oil Gas J.*, 23.12.48, **47** (34), 60.—A major problem of compressor-plant design in the natural-gas industry has been

that of installing equipment which will be fully loaded throughout the life of the operation. As the suction pressure falls it has been necessary to instal additional units, change to larger size cylinders, or convert to two-stage compression. Until quite recently it was the practice to design compressors with minimum clearance. It has been shown that clearance does not affect h.p. requirements, and designers are now specifiying compressors with large cylinders and clearance-pocket openings. This gives a certain amount of flexibility with respect to suction pressure and volumetric efficiency. Considerable expense is involved in these installations. A development has been needed which would enable the original installation to take the gas at minimum anticipated suction pressure keeping the power end loaded, and provide a means of reducing cylinder efficiency so that the large volume at high-pressure available at first can be handled without expensive charges. A compressor piston incorporating clearance pockets in the piston-head can be used on any compressor whose piston is large enough for such pockets. Additional clearance is available for head end or crank end of the cylinder and the clearance arrangement is charged by simply removing or inserting a plug. The expense involved is small, and the advantages considerable. An example of application of the method is described.

C. G. W.

582. Cavitation Flow and N.P.S.H. with Centrifugal Pumps. W. F. Reister. *Petrol. Times*, 17.12.48, **52**, 1095.—Cavitation is accepted as being a state of local vaporization of liquid being pumped. Cavitation may cause serious damage to pumps, and results in reduced capacity, head, and efficiency. Avoidance of cavitation involves prevention of the occurrence of pressures lower than the vapour pressures of liquids being pumped. Pressure reductions within the pump are kept as small as possible by suitable design of the pump.

The term Net Positive Suction Head is defined as the head available or required on the suction line of a pump. The N.P.S.H. required is given approximately by

$$\text{N.P.S.H.} \geqq \Sigma LP + \frac{c^2}{2g} + \lambda\frac{w^2}{2g}$$

where ΣLP = sum of all friction losses ft,
C = average absolute velocity in impeller eye,
W = average relative velocity in impeller channel,
λ = experimental factor.

$\frac{c^2}{2g}$ is the head necessary to maintain inlet passages full of liquid.

$\lambda\frac{w^2}{2g}$ is the head necessary to prevent vaporization in the low-pressure region on the trailing side of the impeller.

The N.P.S.H. available on the suction side is defined as the gauge reading (ft) at the suction branch on the pump centre line minus the vapour pressure (ft) at pumping temp of the liquid being pumped. A formula is given for N.P.S.H. available. The intersection of plots of N.P.S.H. available and required against rate of flow gives the optimum rate of flow for a given system, with a given liquid. C. G. W.

583. Advanced Station Design Enhances Flexibility in Ozark Big Inch. M. A. Hyde. *Oil Gas J.*, 3.2.49, **47** (64), 40.—The new Ozark crude line is a 22-in pipe which runs from Cushing, Okla., to Wood River, Ill., a distance of 435 miles, with an extension of 54 miles to Pakota, Ill.

Six pumping stations with a capacity of 187,000 b.d. are being installed. A feature is constant-speed units with stepped-pressure arrangement.

Arrangements for simplified maintenance and for simplified operation by electrical control are salient features. G. A. C.

584. T.G.T. Stations Equipped with 1600-H.p. Four-Cycle Compressor Units. E. S. Murray. *Oil Gas J.*, 10.2.49, **47** (41), 70.—Tennessee Gas Transmission Co. have built three compressor stations equipped with horizontal, 1600-h.p., four-cycle compressor units.

The programme raised compressor h.p. from 110,000 to 222,000 and necessitated the building of four new stations, and the installation of additional compressors at eleven

stations. The three stations here described were designed and built simultaneously, and are almost identical. Their large compressor units, though expensive to instal, were chosen for long-term economy.

General arrangement, spacing of units, gas piping details, compressor units, auxiliary power, and light are discussed. W. M. H.

585. Cost-imating: Storage Tanks. W. L. Nelson. *Oil Gas J.*, 18.11.48, **47** (29), 123.—Storage ranges from 40 to 100 or more brl/brl of daily capacity, and cost, though it varies with size of tank, ranges from \$1.25 to \$3.54 per brl of storage, or \$50 to \$354 per brl of plant daily capacity.

Tables show costs of storage tanks based on type of material used, year in which erected, and capacity for spherical tanks, and cone roof and standard A.P.I. tanks. Estimated costs are also given for floating-roof tanks and for "guniting" to protect from corrosion.

There are eight literature references. W. M. H.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

586. Corrosion Inhibition with Chromate. 3. Gas Processing Plants and Refineries. M. Darrin. *Oil Gas J.*, 3.2.49, **47** (85), 40.—Uses of chromates in open and closed engine-jacket systems is discussed. Piston cooling, air compressors, and oil cooling are considered, and an illustration of treatment of cooling water in a large compressor unit given.

Tables show chromates consumed (lb of sodium chromate per 1000 sq. ft. of ferrous surface for total days) and rate of consumption per day per million sq. ft. of ferrous surface.

Testing and servicing and optimum proportions are discussed, and combating corrosion in heating systems and boiler feeds dealt with. G. A. C.

587. Dimensionless Groups in Fluid Friction, Heat, and Material Transfer. A. Klinkenberg and H. H. Mooy. *Chem. Engng Prog.*, 1948, **44** (1), 17–36.—The tendency towards the employment of the theory of similitude in the solution of fluid friction, heat, and material-transfer problems in chemical engineering is remarked, and a graphic survey of the dimensionless groups to be considered in such cases is presented. The basic idea of dimensionless groups is outlined, and detailed examples of its application are appended. J. G. H.

588. Heat Transfer: Local and Average Coefficients for Air Flowing Inside Tubes. A. Cholette. *Chem. Engng Prog.*, 1948, **44** (1), 81–88.—A comprehensive study is presented of local coefficients of heat transfer in the transition region between streamline and turbulent flow. The design and operation of a multi-tubular apparatus are described. Local coefficients so obtained are of a high order of accuracy, as indicated by reproducibility of data and heat balances. J. G. H.

589. Spiral Heat Exchanger: Heat Transfer Characteristics. K. W. Coons, A. M. Hargis, P. Q. Howes, and F. T. Weems. *Chem. Engng Prog.*, 1947, **43** (8), 405–414.—Heat-transfer characteristics of spiral exchangers are presented under varying conditions when heating or cooling oil, water, brine, and steam. Flow characteristics of spirals are discussed, and the pressure drop at given values of Reynolds number is shown to be consistently lower than in smooth tubing. The correlation of experimental results with standard heat-transfer equations confirms that the Dittus–Boelter equation is adequate for the calculation of film and overall coefficients under turbulent-flow conditions for spiral exchangers. J. G. H.

590. New Pump. L. W. Lewis. *Rev. sci. Instrum.*, 1948, **19**, 698–700.—A new type of pump is described which has the property of being able to move a fluid without change in pressure, volume, or temp. Against a small external resistance, it can be

used for pressure, vacuum, or circulation of gases, and with a simple attachment liquids may be pumped. It is particularly useful for pumping volatile gases or explosive mixtures. (Author's abstract.) H. C. E.

591. Special Steels for the Petroleum Industry. R. Jackson and R. J. Sarjant. *J. Inst. Petrol.*, 1948, **34**, 445–485.—The major factors to be considered in the selection of special alloy steels for the petroleum industry are reviewed. The heat- and corrosion-resisting properties of these steels are shown to improve with specific additions of alloying elements. The determination of optimum compositions, methods of fabrication, and conditions of service by an extension of statistical examination of behaviour in service trials is recommended. The increasing importance of high-quality castings, the fabrication, being based on the application of radiographic examination, is also stressed. A. R. W. B.

592. Cost-imating Tower Insulation and Platforms. W. L. Nelson. *Oil Gas J.*, 13.1.49, **47** (37), 101.—No. 13 in the series gives tables showing costs of magnesia-block insulation in dollars/sq. ft., areas of insulation for towers or vessels from 2 to 32 ft dia, in sq. ft., and costs of tower platforms and ladders. Year of reference is 1946, cost index 100, and a table relates costs for 1924 to 1948. G. A. C.

Distillation.

593. Effective Absorption and Stripping Factors for Multicomponent Fractionation Calculation. W. C. Edmister. *Chem. Engng Prog.*, 1948, **44** (8), 615–618.—In a previous paper the writer described a new method of making theoretical plate- and component-distribution calculations for multi-component fractionation, consisting of overall equations for each section, employing mol-quantity ratios and absorption and stripping factors. The present paper evaluates the absorption and stripping-factor functions for use in these calculations and indicates short-cut procedures. J. G. H.

Absorption and Adsorption.

594. The Mathematics of Adsorption in Beds. N. R. Amundson. *J. Phys. & Colloid Chem.*, 1948, **52**, 1153–1157.—A complete mathematical solution is offered of the problem in which the adsorption occurs irreversibly at a local rate of removal described by

$$\frac{1}{\alpha} \cdot \frac{\partial n}{\partial t} = kc(N_0 - n),$$

where c = concn in mol/unit vol of adsorbate in the fluid stream,
n = adsorbate on bed in mol/unit vol of bed,
α = fractional void vol of bed,
t = time in sec,
and N_0 = saturation capacity of a unit vol of bed.

D. F. J.

595. Natural-Gasoline Plant Serves Three Fields in Northern Louisiana. D. H. Stormont. *Oil Gas J.*, 13.1.49, **47** (37), 68.—The gas-gathering and compression, absorption and stripping, and auxiliary facilities of the natural gasoline plant of the Sun Oil Co. in the Delhi field, Louisiana, are described.

About 15 million cu. ft gas daily is produced from 350 oil wells in the area, and most is processed in the plant.

Propane, butane, pentanes, and heavier are extracted, 14 million cu. ft gas yielding 19,700, 21,200, and 20,800 gal of the products respectively.

A feature of the main absorbers are the intercoolers resulting in cooler oil stream and more efficient absorption of propane vapours.

Among auxiliary facilities are two 10,000 brl hortonspheroids. G. A. C.

596. New Natural-Gasoline Plant Operates Without Steam, Employs Air Cooling, Has Centralized Control. R. B. Tuttle. *Oil Gas J.*, 3.2.49, **47** (73), 40.—Skelly Oil Co's new gasoline plant at Velma, Okla., processes two types of natural gas, sour and sweet,

6 million cu. ft of sour gas is processed daily via diethanolamine unit, then mixed with sweet gas. No steam is used except for supply water for engine cooling, gas being used for power, and oil vapour instead of steam is employed in all stripping operations.

80% of all cooling operations is achieved by air.

Another feature is method of instrumentation which permits of centralized control. G. A. C.

597. Plant for L.P.G. and Natural Gasoline. F. H. Love. *Petrol. Engr*, July 1948, **19** (10), 41.—This plant is handling 10 million cu. ft. of gas a day, having the high sulphur content of 1600 g/100 cu. ft. Features of the plant are: (1) an ethane stripper to remove ethane, methane, and hydrogen sulphide; (2) all products of the distillation unit pass through the rectifying column; and (3) removal of elemental sulphur from the gasoline by a Perco treating unit. G. K. A.

598. New Unit in Gas Conservation Programme. F. H. Love. *Petrol. Engr*, Sept. 1948, **19** (13), 107.—A new absorption-type gasoline plant, designed for 35 million cu. ft. of gas per day, is considered in detail. The raw gas is compressed to 800 p.s.i. and passed to an absorber where the higher hydrocarbons are removed by absorption oil. The plant is of conventional design. All power is produced by gas engines. G. K. A.

599. Maximum Propane Recovery. Its Economic and Engineering Problems. F. G. Noble. *Oil Gas J.*, 18.11.48, **47** (29), 95.—The demand for propane is steadily increasing, and the economies of propane recovery are influenced by the following factors:—

1. Plant location, product demand, value, and disposition. Position of plant will determine transport costs, and amount of storage necessary.
2. Future field operations. Thus, from estimates of future oil-production rates, engineers may predict future gas volumes and point out any irregularities in production.
3. Investment and increased operating expenses. Investment required for higher initial extraction in an existing plant involves additional compressors, refrigeration, oil circulation, fractionation, boilers, cooling-water system, products storage, and shipping facilities.
4. Selection of maximum recovery.
5. Operating factors. These include maintenance of proper absorption oil, water treating, and control equipment.

Conclusions reached are that high-pressure recovery is expensive, and can only be justified by strong consumer demand, steady product value, and reliable source of gas production. W. M. H.

600. Special Propane Decarbonizing Towers. Anon. *Petrol. Engr*, Sept. 1948, **19** (13), 64.—Two propane decarbonizing towers, 12 ft in diameter, 75 ft in length, and 2⅝ in wall thickness have been built by M. W. Kellogg Co. The technique adopted to build and test these vessels designed for 500 p.s.i. internal pressure is briefly reviewed. These include continuous submerged-arc welding with twenty-four layers of weld per joint, X-ray examination, and stress relieving. G. K. A.

601. Purification and Dehydration of Gases. C. L. Blohm and W. F. Chapin. *Oil Gas J.*, 18.11.48, **47** (29), 75.—Aqueous solutions of ethanolamine may be used for gas purification, while glycol-amine solutions accomplish simultaneous purification and dehydration. In a typical glycol-amine gas-treating plant, sour gas contacts the glycol-amine solution in the absorbing column, and leaves at the top, freed of CO_2, H_2S, and water. The rich glycol-amine solution passes through a regenerating column where acid gases and water are removed. The process is similar for aqueous-amine solutions, except that gases are not dehydrated and regeneration of the solution is more difficult and more expensive. Costs may be reduced by use of a two-stream flow cycle in which the rich solution is split into two streams, one going to the top of the still, and one to the middle.

The economies of both processes are discussed. The article is illustrated by curves and flow-sheets, and there are three literature references. W. M. H.

Cracking.

602. Correlating Reactor Performance in Alcohol Butadiene Process. J. Coull and C. A. Bishop. *Chem. Engng Prog.*, 1948, **44** (6), 443–452.—Methods are enumerated by which pilot-plant data can be used for the evaluation of plant-size reactors. Present paper deals with the consideration of the main driving force of each component in the overall reaction in terms of its concentration in the gas stream and the ultimate concentration on the surface of the catalyst at equilibrium. The H.R.U. (height of reaction unit) concept is explained, and the correlation of aldehyde component, butadiene, and alcohol consumption is discussed. The application of the correlation so obtained to plant-convertor operation is outlined, and data for the construction of a reactivation effectiveness chart are presented. J. G. H.

603. Phillips Butane Dehydrogenation Process: Special Plant Investigations. G. H. Hanson and H. L. Hays. *Chem. Engng Prog.*, 1948, **44** (6), 431–442.—A process is described for the catalytic dehydrogenation of normal butane to butylenes, employing chromia–alumina catalysts in the form of cylindrical pellets, which have a life of over 100 days. Operative conditions include a temperature of about 1100° F, pressure slightly above that of the atmosphere and space velocity of about 850. Effects of the chief reaction variables are discussed, and a detailed investigation is presented of the performance of the individual " harps " in a reactor. J. G. H.

604. Introduction to Fluidization. M. Leva, M. Grummer, M. Weintraub, and M. Pollchik. *Chem. Engng Prog.*, 1948, **44** (7), 511–520.—A description of the fluidization operation is presented, and an investigation of upward or counter gravity fluid flow through beds of fine materials up to the point of bed expansion is reported. The flow of air, carbon dioxide, and helium through beds of round and sharp sands reveals little deviation from cogravity flow, provided there is no bed expansion. The connexion between bed expansion and the onset of fluidization is discussed, and a correlation developed which facilitates the estimation of the fluid rate necessary for initial bed expansion; applications and limiting conditions of this correlation are enumerated, and explanations for slugging and channelling behaviour of fluidized beds are put forward. J. G. H.

605. Fluidization of Solid Particles. R. H. Wilhelm and M. Kwauk. *Chem. Engng Prog.*, 1948, **44** (3), 201–218.—Experimental measurements are presented on fluidization from a quiescent bed to the maximum possible degree of expansion, with water and with air in 3-in and 6-in diameter columns using spherical and uniformly sized particles of sand, glass, silicate catalyst, and lead shot of a wide range of particle density and diameters. Qualitative observations made with 100–200-mesh catalyst material and other fine powders are reported, and pressure drop, fraction void, and velocity are correlated through four dimensionless groups. Particulate and aggregative fluidization are discussed, and an analogy between these type of fluidization and the behaviour of true gases and liquids is suggested. J. G. H.

606. Fluidization of Solid Non-Vesicular Particles. M. Leva, M. Grummer, M. Weintraub, and M. Pollchik. *Chem. Engng Prog.*, 1948, **44** (8), 619–626.—Fundamental correlations for the fluidization of small particles are developed, based on experimental data employing round and sharp sands of five different sizes. The effect of physical properties of the fluids upon fluidization was investigated using air, carbon dioxide, and helium as fluidizing media in 2½-in- and 4-in-diameter glass tubes.

It was found that upward flow does not differ fundamentally from downward flow, provided no bed expansion occurs. The importance of initial bed expansion in relation to initial fluidization is indicated, and a correlation of minimum fluid voidage with effective particle diameter of the material is presented, which in combination with the pressure-drop law through packed beds facilitates the accurate prediction of the onset of fluidization. J. G. H.

607. Sunray Processes 20,000 brl of Crude Daily in Converted Refinery. Anon. *Oil Gas J.*, 3.2.49, **47** (62), 40.—An ex-government-owned 100-octane gasoline plant has been converted to process 20,000 brl of Oklahoma crude, by Sunray Oil Corp., Okla.

Work included laying an 8-in products pipeline to a point 100 miles away, various crude-oil gathering lines and erecting storage tanks.

A topping unit and desalting equipment were necessary, together with a preflashing plant and the gas-concentration system was remodelled to separate the large quantities of propane, propylene, butanes, and butylenes which the re-vamped cat-cracker would produce. G. A. C.

608. Catalytic Processing of Sour Gas Oil. W. M. Carney, H. D. Noll, and A. W. Hoge. *World Petrol.*, 1948, **19** (13), 49–51; *Petrol. Times*, 5.11.48, **52**, 974.—The processing of high sulphur content crude on a T.C.C. unit is described. Low-temp operation with a nominal internal recycling was found preferable, but despite the former condition low-sulphur-content gasoline was produced requiring only a caustic wash for sweetening. The behaviour of plant-construction materials is discussed, and a summarized report of the inspection after a seven months' run given. Alloy protection was applied at critical points only. It is concluded that sour crudes could be satisfactorily handled without alteration to equipment or process. E. B.

609. Design and Operation of Leonard T.C.C. Unit. G. Kelso *et al.* *Petrol. Engr*, Oct. 1948, **1** (20), 293.—The article deals in detail with the design and construction of the Leonard T.C.C. unit designed for 4500 b.d. The performance in the first 3 months of operation is analysed, and the improvements made to the plant are listed. G. K. A.

610. Self Contained Naphtha Polyforming Correlation. W. A. Goldtrap and E. L. Jones. *Petrol. Engr*, Oct. 1948, **1** (20), 269.—Correlation is on the basis of the severity factor—the weight per unit of naphtha change converted to ethane and lighter. Great O.N. improvements are expected from the self-contained polyforming because high increments of high-octane polymers result from recycle gases and naphthas and the cracking is more severe. This was found to be true for a large range of naphthas. G. K. A.

611. A Study of Operating Variables in Thermofor Catalytic Cracking. C. Bednars, D. M. Luntz, and R. E. Bland. *Chem. Engng Prog.*, 1948, **44** (4), 293–306.—The effect on product distribution of variations in temp space velocity, and catalyst activity in the Thermofor catalytic cracking process, cracking a Mid-Continent heavy gas oil over activated clay catalysts, is discussed. Correlations obtained indicate that maximum yields result from a combination of high catalyst activity, low temp, and low-space velocity. Increase in reaction temp improves octane values of gasoline obtained, although gasolines made at higher temp have poorer lead susceptibilities. Details are given of results of changes of variables on yields of gasoline. J. G. H

612. Reactor Design for Manufacture of Toluene by Catalytic Reforming. A. A. Burton, E. B. Chiswell, W. H. Claussen, C. S. Huey, and J. F. Senger. *Chem. Engng Prog.*, 1948, **44** (3), 195–200.—The process used for the manufacture of toluene consists of catalytically reforming a 180–230° F cut from California crude over a molybdena-alumina catalyst in the presence of recycle hydrogen. The reaction is carried out at a total pressure of 200 p.s.i. gauge with a catalyst inlet temp of approximately 1000° F. The reactor effluent is separated by distillation, a 180–225° F boiling-range product is recycled with fresh feed, and a 225–230° F toluene cut is stored for further processing. A description is given of reactor design for this plant employing data from laboratory and pilot-plant operation. J. G. H.

Hydrogenation.

613. Review of Development of Processes for Synthesis of Liquid Fuels by Hydrogenation of Carbon Monoxide. H. H. Storch. *Chem. Engng Prog.*, 1948, **44** (6), 469–480.—The original Fischer–Tropsch process is briefly described, followed by more detailed discussion of developments in Germany and the U.S. since 1938. The characteristic features of all processes, operating temp, pressures, space–time yields, product

distributions, and steel requirements are presented in tabular form. The Synol, Oxo, and *iso*paraffin synthesis processes are described, and the problem of carbon deposition on iron catalysts is discussed. J. G. H.

Chemical and Physical Refining.

614. New Mechanical Filter Replaces Black Wax Sweating Operation. G. Weber. *Oil Gas J.*, 13.1.49, **47** (37), 89.—A new rotary pressure filter, designed by Tide Water Associated Oil Co., Bayonne, N.J., functions as a mechanical wax sweater, charging slack wax cake from conventional cold pressing of wax distillate. It is claimed that the filter has lower utility requirements and investment costs, continuous operation, less space requirements, and less wax in process. Capacities exceeding 50 gal of charge per sq. ft of filter area per hour at operating pressure ranging from 5 to 25 p.s.i. have been obtained.

The filter medium is edge type, and comprises a fine triangular cross-section wire, wound with the apex of the triangle inwards. Working clearance between outside surface of wound working barrel and inner surface of spiral is most effective between 0·01 and 0·1 in.

Prepared slack wax slurry is pumped into the device, where it fills the annular space between outer surface of filter element and inner bore of jacketed cylinder; a table shows results obtained. G. A. C.

Special Processes.

615. Distribution Reaction Products in Benzene Chlorination. Batch vs. Continuous Process Procedures. R. B. McMullin. *Chem. Engng Prog.*, 1948, **44** (3), 183–188.—A mathematical treatment is presented of the distribution of successive chlorination products which results in the substitutive chlorination of hydrocarbons. Details are given of the method as applied to the chlorination of benzene up to and including trichlorobenzene. Experimental methods are outlined which provide data for the production of curves representing the composition of the various components as functions of the amount of chlorine introduced, and which allow the degree of chlorination at which the maximum will occur to be predicted within close limits in regions where experimental technique would be difficult. Separate sets of curves are given for batch chlorination, single-stage continuous chlorination, and for two-stage continuous chlorination. J. G. H.

616. Synthetic Glycerin Plant Goes on Stream. A. L. Foster. *Petrol. Engr*, Oct. 1948, 1 20), 274.—The first synthetic glycerine plant went on stream in September 1948. The reaction is the synthesis of allyl chloride from propylene of cracked gases and chlorine under controlled conditions. The allyl chloride is then reacted with caustic soda, chlorine, and water to give a glycerine–salt solution. This is desalted in large evaporators, given a final desalting under vacuum and purified to give a product 99% true. A simple flow sheet and photographs of the plant are given. G. K. A.

617. Commercial Application of Hydrocarbon Synthesis in the United States. J. E. Latta and S. W. Walker. *Chem Engng Prog.*, 1948, **44** (2), 173–176.—Details are presented of two commercial plants for the synthesis of hydrocarbons and oxygenated derivatives. The feed gas, prepared by partial combustion of natural gas with oxygen at 20 atm pressure, is then led over a cheap iron catalyst in a fluid bed, yielding hydrocarbons as the principal products, with smaller amounts of oxygenated derivatives. While some of the latter constitute valuable raw materials for chemical synthesis and industrial solvents, the full fields of application have yet to be worked out. J. G. H.

618. Hydrogenated Synthetic Gas Production. R. M. Reed and A. Eriksen. *Petrol. Engr*, Oct. 1948, **1** (20), 278.—Hydrogen for petroleum hydrogenation can be produced by passing natural gas and steam over a nickel catalyst and then passing the product over an iron-oxide catalyst to convert carbon monoxide to dioxide. Product contains 95% hydrogen. This process is also used for producing hydrogen for ammonia

synthesis. High-purity hydrogen is produced by a similar process in the Gudlin-Hygirtol plant. The propane–steam mixture after passing through the hydrogen furnace is scrubbed with aqueous monoethanolamine solution to remove carbon dioxide, mixed with more steam, and passed through another furnace to convert carbon monoxide to dioxide. The dioxide is removed and the process repeated three times, the final percentage of carbon monoxide being 0·01. The hydrogen produced has a purity of 99·87%. G. K. A.

Metering and Control.

619. Fractionating Column Instrumentation (I). G. W. Wilson. *Oil Gas J.*, 2.12.48, **47** (31), 63.—Controls for fixed and variable systems of column operation, and their operation of material balance and temp control respectively, are considered in detail.

The fixed system is the simplest type of material-balance control and is exemplified by a process flow for solvents operation.

A fixed system on temp control involving stabilization of the gasoline fraction from a catalytic-cracking operation and subsequent segregation of the propane, butane, and pentane fractions, is illustrated.

A process flow for a variable system employing material-balance control is shown for a hydroformate fractionation unit, and the variables discussed in relation to instrumentation.

The present and proposed instrumentations for a typical column in the series are given.

The re-running of high-purity aromatic solvents where four different feed-stocks are processed provides the example for variable system on temp control.

The use of a flexible-range temp controller, though with a time lag of 10–15 min, permits satisfactory control of liquid level or with near constant degree of fractionation. G. A. C.

620. Fractionating Column Instrumentation. G. W. Wilson. *Oil Gas J.*, 9.12.48, **47** (32), 75.—Temp versus material balance controls are discussed, and instrumentation indicated for a naptha-fractionating unit for the segregation of *cyclo*hexane concentrate. It is shown that intermediate tray temp is satisfactory for this type of superfractionation operation.

A number of charts of typical runs is exhibited.

The maintenance of instruments is essential for accurate operation, and an instrument is no better than the instrument man who serves it.

Specialized types of controllers include a " spilling indicator " which measures the temp of an expanded fluid stream which is removed midway between the plates of a bubble tower. This can be applied to any fractionating column.

Seventeen figures illustrate this article. G. A. C.

621. Crude Oil Metering. J. E. White. *Oil Gas J.*, 11.11.48, **47** (26), 230.—Various meters for measuring flow of crude oil through pipes are described, including differential flow, piston type, nutating-dish, rotating sliding-valve, oscillating-piston, and rotating-bucket types.

The suitability, accuracy, advantages, and disadvantages of the various meters are discussed, and the article is illustrated by thirteen diagrams. G. A. C.

622. Sensitive Mercury Manometer. I. E. Riddington. *Rev. sci. Instrum.*, 1948, **19**, 577–579.—A U-tube-type mercury manometer, in which the volume of mercury flowing between the arms under applied pressures can be measured precisely, is described. The arms of the U-tube are in the form of large-diameter shallow cylinders to give a large flow of mercury for a relatively small pressure change. The flow is measured by determining changes in the volume of mercury in one arm of the manometer. This is done by isolating that arm and adjusting the mercury level to an etch in the capillary; the volume change is then read directly from the position of the end of the mercury thread in a second capillary. Magnifications of pressure change as high as 4000 have been obtained with this device. (Author's abstract.)

H. C. E.

623. Electrokinetic Transducer. M. Williams. *Rev. sci. Instrum.*, 1948, **19**, 640–646.—This device utilizes, for the transformation of sonic to electrical energy, the electrokinetic potential developed by the movement of a fluid through a porous solid. It has been used to measure the pressure fluctuations in oil pipelines.

The transducer consists of a $\frac{1}{4}$-in-diameter pyrex tube containing a fritted disc between two platinum leads which are connected to an oscilloscope. The tube is fitted to a stainless-steel container, and communicates with the outside through a steel diaphragm, of which three, having thicknesses of 0·018, 0·062, and 0·125 in, can be fitted. The tube is filled with redistilled water. The apparatus was tested for frequency response and calibrated with each diaphragm in turn in position, using as pressure sources a constant-speed piston and a spark submerged in water. The variation of output from the instrument with frequency of impinging sound is shown as a graph.

Measurements of pipeline pressures at two stations, one using plunger and the other centrifugal pumps, are described. At the plunger station the records, obtained by commercial pen oscillograph and by visual observation of the oscilloscope, showed that rapid fluctuations were superimposed on a relatively slow fluctuation of *ca* 4 c.p.s. This slow effect was attributed to the piston action of the pumps, and the rapid fluctuations to valve action. At the centrifugal station the frequency fluctuation was about 400 c.p.s. and the amplitude corresponded to a pressure variation of 3 p.s.i. on an average pressure of 1100 p.s.i.

The advantages claimed for the instrument are: (1) frequency response from 0·1 to 10^4 c.p.s.; (2) strong enough to operate at 2000 p.s.i.; (3) rugged enough to withstand severe mechanical vibration and shock; (4) can be calibrated in terms of known pressure variations; (5) in operation does not require voltages which could lead to sparking, with consequent fire risks. H. C. E.

Safety Precautions.

624. Solvent Vapor Control. J. O. Amstuz. *Mech. Engng*, Feb. 49, **71** (2), 143.—Use of solvents in industrial processes results in the presence of explosion risks. When used in saturating or coating continuous sheet materials such as paper or cloth, evaporation rate is high on account of relatively thin coating films and large exposed surfaces. To prevent explosions it is necessary to keep the air–vapour mixture below lower explosive limit around coating machines in drying ovens and especially near surface of the coated sheet material. Safe practice is to keep the mixture well blended with air so that calculated concentration never reaches more than 40% of lower explosive limit. To calculate fresh-air requirements to prevent explosive mixtures, rate of solvent evaporation must be known. A procedure is described for determining this quantity, and upper and lower explosive limits of 133 gases and vapours are given.

Study is also made of health hazards connected with the use of solvents and air required to eliminate them. A. S.

PRODUCTS.

Chemistry and Physics.

625. Vibrational Constants of Acetylene. N. M. Nordin and R. N. H. Haslem. *Canad. J. Res.*, 1948, **26A** (5), 279–291.—The vibrational constants of acetylene have been calc taking into account the resonance interaction arising from the near equality of the fundamentals v_1 and v_3. The calculations are based on the work of Darling and Dennison on the water-vapour molecule. The positions of eight bands have been calc to check the results, and the agreement is very satisfactory. The positions of ten other bands, which have not yet been observed, have been predicted. D. F. J.

626. Decomposition of Alkyl lead Compounds. G. Calingaert, H. Shapiro, F. J. Dykstra, and L. Hess. *J. Amer. chem. Soc.*, 1948, **70**, 3902.—The mechanisms of the decomposition of the ethyl lead chlorides, bromides, carbonates, and hydroxides on steam distillation were investigated. Triethyl lead bromide was also studied under

conditions of spontaneous decomposition at room temperature. Both disproportionation and direct decomposition to lead halides and hydrocarbons were observed. The triethyl lead halides decompose less rapidly under conditions of steam distillation than the corresponding dihalides, the chlorides being relatively more stable than the bromides, while the triethyl lead hydroxide and carbonate decompose more rapidly than the corresponding diethyl lead compounds. G. R. N.

627. Azeotropic Mixtures: Variation of Boiling Point and Latent Heat with Pressure. W. Licht and C. G. Denzler. *Chem. Engng Prog.*, 1948, **44** (8), 627–638.—A study of the vapour-pressure–temp relationship for all possible types of azeotropes from a thermodynamic viewpoint is reported. Conditions necessary and sufficient for azeotropism to exist in any system have been derived, and it is found that equations analogous to the Clapeyron equation should apply to azeotropes in all types of systems. These conclusions are tested and verified by the examination of experimental vapour-pressure data. Data previously scattered through the literature have been collected and correlated.

Three of the systems included in the survey were examined experimentally, and the technique and apparatus for determining the vapour pressure and composition of the azeotropes at various temperatures are described. J. G. H.

628. Rapid Determination of Low Concentrations of Carbon Monoxide in Air. M. Katz and J. Katzman. *Canad. J. Res.*, 1948, **26 F** (8), 318–330.—A granular form of silver permanganate on a zinc-oxide carrier has been found to oxidize CO in air at ordinary temp and at high space velocities. The heat of oxidation is measured in a thermocouple cell. At a definite space velocity the relation between the potential of the thermocouple junctions and the concn of CO is linear over the range 0–600 p.p.m. With increasing flow rate at const concn the potential rises rapidly to a max, but in the range of optimum flow the flow rate may be varied considerably without producing a major change in e.m.f. The method is applicable to the field determination of considerably less than 0·005% CO in air with a precision about equal to that of most laboratory methods. In continuous tests on concns $<0{\cdot}1\%$ CO, 25 cm³ of the material will give a useful life of over 8 hr. D. F. J.

629. Solubility of Bituminous Coal in Alcoholic Potash. N. Berkowitz. *Nature*, 1948, **162**, 960.—A bituminous coal (82·6% C, 5·1% H on ash-free basis) was insoluble in aqueous potash, but dissolved in alcoholic potash to the extent of 20%. The extracted material remained dissolved on dilution with water, but a brown powder was obtained when dilute acid was added. The fractions obtained by treatment of the parent coal with chloroform and pyridine had differing solubilities in alcoholic potash, but the extracts were similar in behaviour.

A high-rank coal (89·7% C, 5·0% H) was only 5% soluble in alcoholic potash, but the extract was similar to that from the bituminous coal. It is thought that the alcoholic potash effects an ester hydrolysis, and that part of the coal substance consists of "humic humates." H. C. E.

630. Extraction of Bright Coals by Anhydrous Ethylene Diamine. I. G. C. Dryden. *Nature*, 1948, **162**, 959.—The addition of anhydrous ethylene diamine ($<1\%$ water) to lower-rank bituminous coals causes large heat evolution and great swelling of the coal, which finally takes up 1·2 g solvent/g. The extract solutions consist of colloidal particles of size 100–1000 Å, with some smaller material. They continue to form stable solutions when poured into water, but can be flocculated by the addition of acid or multivalent cations.

Higher-rank coals swell much less and yield less extract; anthracite is not visibly affected.

At room temp the degree of extraction of low-rank coals approaches a limit of *ca* 10% as the solvent–coal ratio is increased; if the sol is replaced by fresh solvent more extract can be obtained. H. C. E.

631. Mechanism Studies on the Fischer–Tropsch Synthesis using C^{14}. J. T. Kummer, T. W. DeWitt, and P. H. Emmett. *J. Amer. chem. Soc.*, 1948, **70**, 3632.—Fischer–Tropsch synthesis expts using C^{14} as a "tracer" show that the greater part of the

product of synthesis is formed by some process other than by the reduction of carbide as an intermediate. Only about 10% of the hydrocarbon product appears to have been formed through the carbide for iron catalysts at or below 260° C and for cobalt at 200° C; at 300° C the part of the reaction occurring through the carbide-reduction mechanism seems to average about 16%. The per cent formed through the adsorbed phase is not critically dependent on the hydrogen : carbon monoxide ratio in the range 1 : 1 to 3 : 1, on the total pressure of the synthesis, within the limits 150–860 mm pressure; or on the per cent Fe_2C initially present in the range 4–100%. The exchange of the carbon in the gases methane, butane, butene-1, and acetylene, with an iron-carbide surface at 250° C is very low; carbon-monoxide exchange with the carbon in the carbide is only about 5% in 30 min at 250° C, but is as high as 29% in 7 min at 322° C. G. R. N.

632. Further Alkylbenzene Spectra to 1750 A. J. R. Platt and H. B. Klevens. *J. Chem. Phys.*, 1948, **16**, 832–834.—The absorption curves of *n*-butyl-, *sec.*-butyl- and *tert.*-butyl-benzene, and of 1 : 3 : 5-trimethyl-benzene have been observed to about 1750 A in *n*-heptane solution. A. R. W. B.

633. Some Characteristic Frequencies in the Raman Spectra of Saturated Aliphatic Hydrocarbons. N. Sheppard. *J. Chem. Phys.*, 1948, **16**, 690–697.—The data presented in a recent review of Raman spectra of saturated hydrocarbons have been analysed with a view to the determination and assignment of vibration frequencies that are characteristic of particular molecular groups. Approx assignments have been suggested for the rocking and wagging modes of CH_2 groups (720–760 cm^{-1} and 1300–1340 cm^{-1}, respectively) and for the deformation modes of CH groups (1330–1360 cm^{-1}) in such hydrocarbon molecules. Assignments previously made for the analysis of Raman spectra of *iso*butane (trimethyl methane) and *neo*pentane (tetramethyl methane) have been received and the results applied to the interpretation of observed characteristic frequencies of singly and doubly branched paraffins. A. R. W. B.

634. Vibrational Frequency Assignments for Paraffin Hydrocarbons; Infra-Red Absorption Spectra of the Butanes and Pentanes. R. S. Rasmussen. *J. Chem. Phys.*, 1948, **16**, 712–726.—The infra-red absorption spectra from 2 to 15μ are given for *n*-butane, *iso*butane, *n*-pentane, *iso*pentane, and *neo*pentane. Vibrational assignments for these molecules and for propane are deduced. The band positions which can be correlated with particular types of vibration of various hydrocarbon groupings are discussed. A. R. W. B.

635. Isomerization of *n*-Butane-1-C^{13}. J. W. Otvos, D. P. Stevenson, C. D. Wagner, and O. Beeck. *J. Chem. Phys.*, 1948, **16**, 745.—The reactions of *n*-butane-1-C^{13} in the presence of a water-promoted aluminium-bromide catalyst have been investigated at approx 25° C. The results of these experiments provide no experimental basis for theories of the paraffin-isomerization reaction which postulate attack of the molecule at a particular point, followed by migration of a methyl group. Rather do they point towards a general activation of the molecule as a whole. A. R. W. B.

636. Heat and Free Energy of Polymerization of Ethylene. R. S. Jessup. *J. Chem. Phys*, 1948, **16**, 661–664.—Values are given for the heats and free energies of polymerization of gaseous ethylene to gaseous, straight-chain polyethylene (monoolefin) molecules of various lengths as calculated from available thermochemical data. Equations are also given expressing these properties at 25° C as functions of *n*, the number of ethylene units per polymer molecule for $n \geq 3$.

The equilibrium concentrations of ethylene and all its polymers at various temp in a mixture in the ideal gas state at a pressure of 1 atm. are shown graphically and in tabular form. A. R. W. B.

637. Liquid Phase Oxidation of Ethylbenzene. W. S. Emerson and others. *J. Amer. chem. Soc.*, 1948, **70**, 3764.—The free radicle mechanism for the air oxidation of tetralin, proposed by Robertson and Waters, is used to explain certain features of the air oxidation of ethylbenzene. G. R. N.

638. Hydrogen Transfer II. H. Pines, A. Weizmann, and V. N. Ipatieff. *J. Amer. chem. Soc.*, 1948, **70**, 3859.—*Iso*propyl-*p*-cymene and *cyclo*hexyl-*p*-cymene reacted with 3-methyl*cyclo*hexene in the presence of hydrogen fluoride as catalyst. Hydrogen transfer was the main reaction; the aromatics acted as hydrogen donors and the methyl*cyclo*hexene as a hydrogen acceptor; it amounted to 60% and 40% respectively. Part of the substituted *p*-cymene apparently reacted with methyl*cyclo*hexene to form the expected *cyclo*alkylation product. G. R. N.

639. Absorption Spectra of Methane in the Near Infra-red. R. C. Nelson, E. K. Plyler, and W. S. Benedict. *Bur. Stand. J. Res., Wash.*, Dec. 1948, **41** (6), 615.—There are two strong bands in the infra-red spectrum of methane—two fundamental frequencies. The other two fundamentals are not active in the infra-red, although these frequencies may appear in combination bands with the other frequencies and their overtones to give bands in the near infra-red. In work described, high resolution was obtained by a grating spectrometer employing a PbS photo-conducting cell for detector. Measurement was made of infra-red absorption bands of methane in region of 1·66μ and the strong rotational lines of the P and R branches of the $2\nu_3$ band of methane can readily be identified. Using a smaller pressure of gas, better separation of the stronger components of the Q branch was obtained. The lines for values of J up to 10 are sharp, showing no indication of splitting due to interaction with neighbouring states or to centrifugal distortion. The rotational constants obtained for this band are given. Other bands observed are more complex and irregular, probably due to mutual interaction. A. S.

640. Kinetics of Methane Synthesis. W. W. Akers and R. R. White. *Chem. Engng Prog.*, 1948, **44** (7), 553–566.—The formation of methane from hydrogen and carbon monoxide over an active nickel catalyst is discussed, and the effects of variables, concentrations, and temp are correlated. Equations are presented for the rate of methane synthesis reaction and for the rate of formation of carbon dioxide. The rate of formation of carbon dioxide remains almost constant until the rate of methane formation has decreased to this rate; thereafter the two rates are equal. J. G. H.

641. Hydrogenation of α-Methylnaphthalene. H. Shanfield and E. A. Smith. *Canad. J. Res.*, 1948, **26B** (11), 763–765.—Describes the preparation and properties of hydrides of α-methylnaphthalene, (I), and the identification of some of the products of the destructive hydrogenation of I. D. F. J.

642. Reaction of Maleic Anhydride with Polynuclear Aromatic Hydrocarbons. R. N. Jones, C. J. Gogek, and R. W. Sharpe. *Canad. J. Res.*, 1948, **26B** (10), 719–727.—A description is given of a qualitative investigation of the reaction of various polynuclear aromatic hydrocarbons with maleic anhydride, and of a micromethod for the separation of polynuclear aromatic hydrocarbons based on this reaction. D. F. J.

643. Reactions of Paraffins with Phosphorus Trichloride and Oxygen. J. O. Clayton and W. L. Jensen. *J. Amer. chem. Soc.*, 1948, **70**, 3880.—A new synthesis for alkane and *cyclo*alkane phosphonyl chlorides is described. It involves the reaction of a hydrocarbon with phosphorus trichloride and oxygen and has been used in the synthesis of several new alkane and *cyclo*alkane phosphonyl chlorides and phosphonic acids, properties of which are presented. G. R. N.

644. Dielectric Relaxation-Times of Solid Solutions of Aliphatic Long-Chain Esters and Ketones in Paraffin Wax and *n*-Hexacosane. R. J. Meakins. *Nature*, 1948, **162**, 994.—Measurements of dielectric loss (tan δ) over a range of frequencies at $22 \pm 0{\cdot}5°$ C are reported for: (1) decyl laurate in paraffin wax; (2) decyl laurate in *n*-hexacosane; (3) laurone in paraffin wax; (4) laurone in *n*-hexacosane; and the relaxation times are calc from the angular frequencies for the maximum tan δ. Results show that systems 3 and 4 are true solid solutions in which the polar molecules replace hydrocarbon molecules in the crystal structure. In system 1, however, the ester molecules fit loosely into amorphous regions in the solvent, while system 2 is a eutectic consisting of *n*-hexacosane interspersed with aggregates of ester molecules. H. C. E.

645. Kinetics of Polymerization of Propylene. C. M. Fontana and G. A. Kedder. *J. Amer. Chem. Soc.*, 1948, **70**, 3745.—The kinetics of propylene polymerization by means of $AlBr_3$ in the presence of HBr have been investigated, and a mechanism which accounts for the experimental data has been proposed. The heat of polymerization of propylene was approximately 16·5 k. cal/mol. G. R. N.

646. A Further Investigation of Mercury Photosensitized Polymerization of Propylene. H. E. Gunning and E. W. R. Steacie. *J. Chem. Phys.*, 1948, **16**, 926–930.—The authors' earlier work on the reaction of propylene with mercury ($^3P_1$) atoms has been reinvestigated. The mechanism of the reaction which was proposed in this has been confirmed. A. R. W. B.

647. Some New Alkyl Tetralins and Naphthalenes. R. T. Hart and S. A. Robinson. *J. Amer. chem. Soc.*, 1948, **70**, 3731.—Seven new 6-*n*-alkyl and 6 : 7-di-*n*-alkyl tetralins and six new 2-*n*-alkyl and 2 : 3-di-*n*-alkyl naphthalenes have been synthesized and their physical constants determined. Five other monoalkyl and dialkyl tetralins and naphthalenes were synthesized and tested. Values for the specific refraction, the observed molecular refraction, the theoretical molecular refraction, and the specific exaltation were calc. There is a well-defined linear relationship between the boiling points and the number of carbon atoms when the data are segregated into groups according to molecular types. G. R. N.

648. Alkylation of Thiophene with Olefins. P. D. Caesar. *J. Amer. chem. Soc.*, 1948, **70**, 3623.—Sulphuric acid, dihydroxyfluoboric acid, aluminium chloride, and boron trifluoride complexes with water or organic oxygen-containing compounds were found to promote the alkylation of thiophene with *iso*butylene, pentenes, di*iso*butylene, 1-octene, and 1-hexadecene. Several new mono- and dialkyl-thiophenes were prepared. G. R. N.

649. Vapour Pressures of Trimethylbenzenes. E. R. Hopke and G. W. Sears. *J. Amer. chem. Soc.*, 1948, **70**, 3801.—The vapour pressures of the three isomeric trimethylbenzenes were measured in the region 0·01–1·0 mm by a Rodebush manometer. The data were fitted to the equation $\log_{10} P = B - A/T$ by the method of least squares. G. R. N.

650. Synthesis of Triptane. V. I. Isagulyantz. *Neft. Khoz.*, 1948, (11), 49–56.—A review. The early work of El'tekov (*J. Russ. Phys. Chem. Soc.*, 1882, **14**, 378) on the methylation of olefins by a methyl halide, which led to his synthesis of 2 : 3 : 3-trimethylbutene, is discussed in some detail, and the more modern applications of this reaction are described. Recent American work on the preparation of triptane by the demethylation of *iso*octane and by the cat alkylation of *iso*butane with propylene is also considered. V. B.

651. Structures of Micelles of Colloidal Electrolytes. III. A New Long Spacing X-Ray Diffraction Band and the Relations of Other Bands. R. W. Mattoon, R. S. Stearns, and W. D. Harkins. *J. Chem. Phys.*, 1948, **16**, 644–658.—A newly discovered X-ray diffraction band, obtained from aqueous solutions of soaps and detergents, gives a Bragg spacing which is independent of concentration and is close to the double length of the molecule. This is designated as the micelle thickness or M-band. The already known long-spacing band, interpreted as being related to the intermicellar distance, is designated as the I-band. If a hydrocarbon is solubilized in the micelles, these spacings increase by Δd_M and Δd_I, and it is now thought that Δd_M is the more directly related to the mean thickness of the layer of oil dissolved between the ends of the hydrocarbon chains of the soap molecule in its micelle. The number of molecules in a potassium-myristate micelle is calc. as 56 at 9·8% concn. The "cylindrical" model of the micelle now preferred differs in some respects from previous conceptions. A micelle consists of one double-layer of soap or detergent molecules, and the thickness of the micelle of a pure soap is essentially twice the length of the soap molecule, independent of concentration. Hydrocarbons solubilize inside the micelle between two layers of soap molecules and thus make the micelle thicker. The area per soap molecule in the micelle remains practically constant whether or not solubilized hydro-

carbons are present. The width of the micelle and the number of soap molecules per micelle increase with increasing soap concentration and with solubilization of hydrocarbons. A. R. W. B.

652. Vapor–Liquid Equilibria in Hydrocarbon Systems. 1. S. T. Hadden. *Chem. Engng Prog.*, 1948, **44** (1), 37–54.—The use of the equilibrium–vapourization constant, K, for the relevant hydrocarbons in design calculations for the construction of recovery and refining equipment is remarked, and the superiority of experimentally determined equilibrium–vapourization constants over calculated data is emphasized. A practical working procedure is presented for obtaining vapour–liquid equilibria in hydrocarbon systems from low pressures up to the convergence pressure of the system. Three nomograms are given for ideal equilibrium–vapourization constants from −200° to 1000° F at pressures from 10 to 2000 p.s.i.a. The range of materials considered includes hydrogen, light paraffins, and mono-olefins up to narrow-boiling-range cuts boiling at 1100° F. Correlations are presented for obtaining the deviation of the Ks from their ideal values as convergence pressure is approached, and for obtaining K of non-hydrocarbons frequently occurring in hydrocarbon streams as contaminates of process materials. J. G. H.

653. Vapor-liquid Equilibria in Hydrocarbon Systems. 2. S. T. Hadden. *Chem. Engng Prog.*, 1948, **44** (2), 135–156.—Three nomograms are given correlating the experimental ideal value of the equilibrium vapourization constants for hydrocarbons. One nomogram will generally give acceptable value for CH_4 in binary mixtures when the second component is heptane or a heavier hydrocarbon. For other binary and for complex mixtures the K for CH_4 must be corrected; two correlations are given effecting this. The divergence of K from the ideal values obtained from the nomograms as the convergence pressure is approached is explained, and data are given for the construction of component lines on the nomograms for non-hydrocarbons which give reliable ideal K values for such components in hydrocarbon mixtures. J. G. H.

654. General Theory of the Formation of Liquid Films. L. B. Robinson. *J. Chem. Phys.*, 1948, **16**, 734–736.—Langmuir's theory of the formation of liquid films in narrow capillaries is developed for the general case of any electrolyte. A. R. W. B.

655. Effect of Sulfur Compounds on Octane Number of Leaded Fuels. 2. H. K. Livingston. *Oil Gas J.*, 20.1.49, **47** (38), 67.—Data is given describing and interpreting the antagonism of selected sulphur compounds towards tetra-ethyl lead in widely differing fuels.

Four sulphur compounds were investigated, and their effect on the leaded O.N. determined as function of tetra-ethyl-lead concentration, O.N. of base fuel, and character of the hydrocarbons in the fuel.

Decrease in tetra-ethyl-lead efficiency is independent of tetra-ethyl-lead concentration and fuel O.N., and is constant for *n*-heptane blends containing thiol or disulphide when the component blended with the heptane was changed from *iso*-octane to toluene or *cyclo*hexane. Sulphides are less antagonistic towards tetra-ethyl lead in *cyclo*hexane–heptane blends than in other fuels examined. In *iso*-octane–heptane blends thiophenic sulphur appears least antagonistic.

The work is illustrated by eleven tables and four figures. G. A. C.

656. Thermodynamic Properties of Hydrogen Sulfide. J. R. West. *Chem. Engng Prog.*, 1948, **44** (4), 287–292.—Thermal properties of hydrogen sulphide in the saturated and superheated state derived by the use of fundamental data and basic thermodynamic equations are presented. Thermodynamic properties of saturated hydrogen sulphide from −76·4° to 212·9° F and from pressures of 1 to 88·9 atm and of superheated hydrogen sulphide from 40° to 1300° F and from 1 to 70 atm are tabulated. J. G. H.

657. Thermodynamic Properties of Methyl Alcohol. J. M. Smith. *Chem. Engng Prog.*, 1948, **44** (7), 521–528.—Previous work on thermodynamic properties of methyl

alcohol is discussed. Data for the ideal gas state at 1 atm pressure at temp from 298° to 1000° K, derived from spectroscopic sources are tabulated, and properties of saturated liquid and saturated vapour are presented from 32° to 464° F and from 0·571 to 1155 p.s.i. pressure. Methods of obtaining enthalpy and entropy data are explained. J. G. H.

658. Study of the Rheological Properties of Rapidly Thickening Colloidal Systems by Means of the Stormer Viscometer. H. G. Higgins and K. F. Plomley. *Nature*, 1949, **163**, 22.—The viscosity η as measured in the commercial Stormer viscometer can be represented by $\eta = KWt$ over the following range of variables: η, 2–75 poises; actuating weight W, 100–500 g; time t for 100 revolutions, >18 secs. The constant K is experimentally determined by the use of glycerine solutions and mineral oils of known viscosity. For values of η between 0·015 and 2 poise, and of W between 10 and 100 g. an additional term is required.

The plot of W against $1/t$ in the applicable range gives straight lines passing through the origin for Newtonian liquids, and deviations from Newtonian flow are readily seen. Several systems in which thickening occurred showed practically Newtonian behaviour until the abrupt transition to a gel stage; and it is suggested that such systems be recognized as a distinct type, since the criteria of Newtonian deformation refer to purely rheological conditions, whereas in these systems, irrespective of whether they are subject to stress, η is changing with time. H. C. E.

659. Rigidity of Molecules in Linear Chains and its Relation to the Viscosity and Flow Birefringence in Dilute Solutions. W. Kuhn and H. Kuhn. *Rev. Inst. franç. Pétrole*, 1948, **3**, 207–221.—The shape of long mol in solution is considered and the factors giving rise to internal visc of the mol are treated mathematically. In a flowing solution such mol are subjected to various forces, translation, rotation, and a periodic alternation in the distance separating the ends of the mol. Such changes of shape, whose amplitude is a function of the internal visc, are reflected in the visc and flow birefringence of solutions. Thus a knowledge of the latter factors enables the internal visc, the relaxation time, and the periodicity of the spontaneous changes of shape of the mol to be deduced. V. B.

Analysis and Testing.

660. Work at Thornton Research Centre. I. Determination of Cetane Number of Small Fuel Samples. Anon. *Gas Oil Pwr*, 1948, **43**, 419–421.—The cetane-rating test is carried out on a Gardner single-cylinder engine which is run on a bulk fuel supply until steady conditions are obtained, when a change-over is made to the sample under test. Minimum wastage and freedom from contamination of sample by bulk fuel are ensured by using a system of pipes and three-way cocks such that: (1) the path traversed by the sample is very short; (2) the inlet pipe can be flushed by the sample; (3) excess fuel is re-circulated. The correct sequence of operations is ensured by fitting the cocks with interlocking plates. The test fuel is contained in a 200-ml cylinder fitted at the bottom with a cock, so that by using more than one container several samples can be tested in quick succession. The equipment permits a rating based on four misfire-point observations to be made with 50 ml of fuel.

H. C. E.

661. Photoelectric Measurement of a Colour Index of Light Petroleum Products. L. Lykken. *A.S.T.M. Bull.*, Oct. 1948, **154**, 68–73.—A rapid reproducible method for the photo-electric measurement of a colour index for petroleum products is described, depending on the measurement of transmitted light by a photo-electric colorimeter with specified characteristics, and equipped with a broad-band "north sky" and narrow-band red and violet colour filters.

The method is reproducible, covers the complete range of colour intensities, and is also applicable to waxes and materials that melt at 40° C or lower. Basically more sound than visual methods, it is of particular value as a specification or control-test method for lub oils, and, with certain modifications, can be applied to liquids with spectral characteristics differing appreciably from typical petroleum products.

J. G. H.

662. Automatic Distillation Apparatus for A.S.T.M. Method D-86. F. B. Rolfson, C. J. Penther, and D. J. Pompeo. *Anal. Chem.*, 1948, **20**, 1014.—An apparatus is described which automatically plots a complete distillation curve in accordance with the standard A.S.T.M. D-86 procedure. The operator need only fill the distillation flask with liquid, insert the chart paper, and set the initial heat; the apparatus performs the distillation, recording all required data such as correction temp, initial boiling point, end point, and distillation rate. When the distillation is completed the apparatus automatically resets itself for the next test. G. R. N.

663. Determination of Small Amounts of Benzene in Ethyl Alcohol. D. L. Kouba, L. R. Kangas, and W. W. Becker. *Anal. Chem.*, 1948, **20**, 1063.—The sample of alcohol is diluted with water and partially distilled; the alcohol fraction containing the benzene azeotrope is collected and extracted with hexane. The refractive index of the hexane–benzene mixture is measured, and its benzene concentration read from a graph. The method is intended for concentrations of 0·05 to 1·0% by vol benzene in ethyl alcohol. G. R. N.

664. Determination of Polymer in Furfural. J. C. Hillyer and A. J. Deutschman. *Anal. Chem.*, 1948, **20**, 1146.—A vacuum-distillation method is described for determination of the polymeric residue which is formed in furfural on exposure to heat and other degradative conditions during use in extractive distillation and solvent refining. After removal of the furfural the polymer residue was brought to constant weight by several successive evaporations with small amounts of acetone. G. R. N.

665. Improved Demonstration Experiment on Gas Adsorption. F. Blankenship and P. Donaldson. *J. chem. Education*, 1949, **26**, 105.—Lecture demonstrations of gas adsorption are often unsatisfactory due to time required, difficulty of observation, and lack of clear distinction between adsorption and non-adsorption. Improved demonstration can be obtained by passing natural gas saturated with methyl borate over activated charcoal. The natural-gas supply is passed through or over an alcoholic solution of boric acid and thence to a **Y** connection. One fork of the **Y** connection leads directly to a laboratory burner, while the other passes the gas through a small bed of adsorbent material and then to another burner. With adsorption taking place the resulting flame is clear; without adsorption the flame is brilliant green. Apparatus is described for carrying out this demonstration. After several minutes burning the adsorbent bed may become saturated. The ester can be stripped from the adsorbent by substituting pure methanol for the boric-acid solution. Activated alumina and silica gel can also be used as the adsorbent material. The amount and nature of adsorbent affects time for saturation to take place, as do rate of gas flow and method of bringing the gas into contact with ester solution. A. S.

666. Gas Adsorption Apparatus. M. Lafitte and T. Reis. *Rev. Inst. franç. Pétrole*, 1948, **3**, 285–292.—A description of an adsorption apparatus intended for industrial routine use and designed for investigating the pore structure of solid materials. The equipment is suitable for obtaining the adsorption isotherm (with nitrogen at low temp), whence the surface area can be calc, and for determining real density (using helium at room temp) and pore structure (by low-temp adsorption of various gases). The apparatus can be used for surface areas 1–1000 m^2/g, temp $-196°$ to $+200°$ C and pressures 10^{-6} mm to over atmospheric. The operating procedure is given, and the calculation of results explained. V. B.

667. Isomeric Xylene and Ethylbenzene Mixtures. W. I. Kaye and M. V. Otis. *Anal. Chem.*, 1948, **20**, 1006.—A liquid-phase method is described for the quantitative analysis of mixtures of these aromatic hydrocarbons in carbon disulphide as solvent. The infra-red absorption-coefficient abnormalities are reported for varying concentrations. G. R. N.

668. Interfacial Tension at Elevated Pressures and Temperatures. I. A New and Improved Apparatus for Boundary-Tension Measurements by the Pendent-Drop Method. E. A. Hauser and A. S. Michaels. *J. Phys. & Colloid Chem.*, 1948, **52** (7), 1157–1165.—The apparatus described may be used in the range 20–200° C and 0–10,000 p.s.i. It

is thus very suitable for work in the field of petroleum production. The new features are: (1) the use of a "concentrated-arc" lamp coupled with a highly corrected parallelizing lens and a monochromatic filter to obviate the need for a telecentric lens, and (2) the use of a special photomicrographic camera. The high-pressure equipment is described. The windows of the cell are generally not gastight, and so the use of this new apparatus is limited to the extent that the cell chamber must always be filled with liquid.

The apparatus will be used to measure the press and temp coefficients of interfacial tension between pure hydrocarbons and water. D. F. J.

669. An Example of the Application of Infra-red Spectrography. L. Robert. *Rev. Inst. franç. Pétrole*, 1948, **3**, 278–280.—The infra-red spectrum of a synthetic mixture of 80% heptane, 14% toluene, and 3% each 1-heptene and *cyclo*hexene is given and compared to that for the product obtained by the cat aromatization of heptane to toluene. The latter mixture is shown to contain, in addition to *n*-heptane and toluene, 3-heptene, methyl-3-*cyclo*hexene, and (probably) 1 : 5-dimethylnaphthalene and higher condensed aromatics. The rapidity of infra-red analysis for such work and its superiority over Raman analysis (which would require preliminary dist) is pointed out. V. B.

670. Determination of Oxygenated and Olefin Compound Types by Infra-red Spectroscopy. J. A. Anderson and W. D. Seyfried. *Anal Chem.*, 1948, **20**, 998.—A laboratory investigation of the relationship between molecular structure of organic compounds and their infra-red-absorption spectra in the liquid phase has resulted in development of procedures for the quantitative determination of individual compound types in complex mixtures. The methods are based upon the facts that, usually, the presence of certain functional groups in the molecules causes each compound of a given type to absorb infra-red radiation at a constant wavelength characteristic of the functional group; and when expressed on the proper basis, the absorption coefficient for each functional group is essentially constant, regardless of mol wt. At present, it is possible to make determinations for the functional groups of alcohols, aldehydes, carboxylic acids, esters, ketones, and five different olefin types in complex samples such as hydrocarbon synthetic naphthas. G. R. N.

671. Lamp for Burning High-Boiling Petroleum Fractions. S. G. Hindin and A. V. Grosse. *Anal. Chem.*, 1948, **20**, 1050.—In lamp procedures previously developed for the determination of hydrogen, carbon, and sulphur in gasolines, the sample is burned in a lamp, and the combustion products are collected and determined. A modified lamp design is described, which allows extension of the method to petroleum fractions boiling within the range 250–500° C. G. R. N.

672. Note on the Application of Ultrasonics to the Preparation of Samples for the Electron Microscope. R. Anglade and T. Reis. *Rev. Inst. franç. Pétrole*, 1948, **3**, 313–316.—Satisfactory dispersions of carbon blacks, aluminosilicate cat, and drilling muds in alcohol–water and benzene have been obtained. Irradiation periods vary from a few min to >1 hr using a piezo-electric generator operating at 961 *kHz* with a power of 16 W. Results vary with the materials employed, and in some cases ultrasonic irradiation can cause agglomeration in place of dispersal. V. B.

673. Analysis of Mineral Waters. 1. L. C. Case and D. M. Riggin. *Oil Gas J.*, 23.12.48, **47** (34), 74.—It is attempted to standardize and summarize the best available methods for laboratory examination of waters. In this part, determination of alkalinity total solids and chlorides is dealt with. C. G. W.

674. Analysis of Mineral Waters. 2. L. C. Case and D. M. Riggin. *Oil Gas J.*, 6.1.49, **47** (36), 72.—The last part of this article deals with the estimations of sulphate, calcium, magnesium silica, iron, H_2S, and pH value. Calculation of results and the statement of analysis are discussed. References are given. C. G. W.

675. Rates of Spreading of Solutions of Surface Active Agents. J. Hyypia. *Anal. Chem.*, 1948, **20**, 1039.—A measured volume of liquid or solution is placed upon the

surface and automatically photographed at definite time intervals. Any plane surface, whether transparent or opaque, may be used. Measurements of the resulting series of photographic images are plotted against elapsed times to obtain curves which indicate the relative rates of spread of the solutions under comparison. The rate of spreading is shown to be a function of the nature of the surface on which spreading takes place. G. R. N.

676. Determination of Elementary Sulphur in Aromatic Hydrocarbons. H. E. Morris, R. E. Lacombe, and W. H. Lane. *Anal. Chem.*, 1948, **20**, 1037.—A volumetric method based upon the reaction $S + Na_2SO_3 \longrightarrow Na_2S_2O_3$ was developed for elementary sulphur in the range 0·1–20% in aromatic hydrocarbons. Both this and the butyl-mercaptan methods were found to be unsatisfactory when the amount of sulphur was in the range 0–100 p.p.m. G. R. N.

677. Lamp Method for Quantitative Determination of Total Sulphur. W. H. Lane. *Anal. Chem.*, 1948, **20**, 1045.—An investigation of the variables of the lamp method has shown that it cannot be used for the quant determination of elementary sulphur or for total sulphur unless elementary sulphur is known to be absent. Complete recovery of sulphur from the combustion of solutions containing volatile organic sulphur compounds has been effected only under highly specialized conditions. G. R. N.

678. Some Modifications of the Lamp Method for the Determination of Sulphur in Petroleum Products. G. E. Mapstone. *J. Inst. Petrol.*, 1948, **34**, 486–489.—Burning rates of up to 19 g of gasoline/hr have been achieved by modifying the chimney of the lamp sulphur apparatus, the standard absorber being quite efficient at the higher rates. A simple modification of the lamp is also described which enables greater burning rates to be obtained with kerosine samples. A. R. W. B.

679. Simple Recording System for Mass Spectrometers. V. H. Dibeler, R. B. Bernstein, and T. I. Taylor. *Rev. sci. Instrum.*, 1948, **19**, 719.—The application of this pen-recording system to the mass spectrometer has the advantage of simplicity of construction and maintenance. The electrical circuit and its method of operation are described in detail. It is applied to a 60° mass spectrometer of the Nier type, and a typical mass spectrum of *n*-butane is shown. The reproducibility is said to be $\pm 3\%$ of the intensity of the principal ions. H. C. E.

680. High-accuracy Thermostatic Equipment. R. Darmois. *Rev. Inst. franç. Pétrole*, 1948, **3**, 281–284.—A thermostat is described in which the water is heated by infra-red radiation from a lamp placed above the water level. If the temp required is >7–$8°$ C above ambient an additional continuously operating immersed heater is required. Temp control to 0·005° C is given by a large toluene–mercury regulator. A suspended level viscometer tube has been specially designed for determining the visc of dilute solutions, giving a flow rate in the capillary of less than 7 cm/sec. It is claimed that with this equipment the relative visc of similar solutions can be determined with an accuracy of 1 in 10,000. V. B.

681. New Form of Viscometer for Transparent Liquids. A. A. Elkarim. *Rev. sci. Instrum.*, 1948, **19**, 833.—The apparatus consists of a capillary tube entering the base of a glass cell which contains the test liquid. Air pressure in the capillary is slowly increased until a bubble is detached and rises through the liquid, and its terminal velocity is found by timing it over a measured height of liquid. The viscosity η is calculated from the equation: $6v\eta = g\tau[h\rho/2 + 4r(\rho - \delta)/3]$; where v is the velocity of the bubble, ρ and δ are the densities of liquid and air, h is the height of liquid in the cell, and r is the capillary radius. Viscosities of glycerine and methyl salicylate are reported, and show good agreement when variations are made in the values of r and h. H. C. E.

682. Conversion from Empirical to Absolute Viscosity Scale. M. Brunner. *Schweiz. Arch. Ang. Wiss. Tech.*, 1949, **15**, 31–32.—A plea for the abandonment of the Engler

scale and transfer to kinematic visc units. A conversion table cs/E° for the range 2–160 cs is given. V. B.

683. Determination of Viscosity Corrections. E. L. Lederer. *Schweiz. Arch. Ang. Wiss. Tech.*, 1948, **14**, 372–377.—An expression is derived for calc the correction to be applied to convert a visc determined at a temp varying up to 1° C from a standard temp to the visc at the standard temp. A knowledge of the pole-height of the oil is necessary. Tables are given for temp 0°, 20°, 50°, and 100° C for the ranges 2–1000 cs and pole-heights 1·5–4·0. A graphical method, valid for 1° C deviations from any temp, is also described. V. B.

Engine Fuels.

684. Two-Stage Ignition of Higher Hydrocarbons at Atmospheric Pressure. G. Friedlander and L. Grunberg. *J. Inst. Petrol.*, 1948, **34**, 490–510.—Ignition experiments have been carried out with a Moore-type apparatus in the "low-temp region." With *n*-heptane, ignition was found to be preceded by a "pre-ignition pulse," which persisted at temps at which ignition did not yet occur. With *n*-heptane–benzene mixtures three distinct regions were observed. Between a high-temp region characterized by ignition and a low-temp region in which only the pre-ignition pulse occurs there exists a region in which only slow oxidation occurs. Gas samples were collected at different stages of the reaction and were analysed for CO, CO_2, O_2, C_nH_{2n}, alkyl–hydrogen peroxides, and aldehydes. The decline of an alkyl–hydrogen peroxide maximum was found to be responsible for the "pre-ignition pulse." A theoretical explanation of a chain reaction in accordance with the experimental results is presented. A. R. W. B.

685. Oxidation, Ignition, and Detonation of Fuel Vapours and Gases. VII. Oxidation of Pentane in Varying Concentration in Air at Temperatures Rising to 700° C and the Effect of Iron Carbonyl on Reaction Velocity. R. O. King. *Canad. J. Res.*, 1948, **26F** (10), 426–440.—Experimental results for undoped mixtures of pentane and air show that at temps approaching those of the end gas in an engine, reaction velocity increases by 100% on increasing mixture strength from 25% weak to 100% rich, and by 100% on increasing the temp from 600° to 650° C. For mixtures doped with iron carbonyl, similar increases in reaction velocity are obtained with increase of mixture strength and with temp, but at temps 150° C lower than for undoped mixtures. It is stated that the results confirm the conclusion of earlier Parts that the oxidation of pentane in the conditions of the experiments is a heterogeneous reaction. D. F. J.

686. Enthalpy-Entropy Diagram for Air and its Application to the Thermodynamic Study of Turbo-Jet Cycles. N. Manson and F. Ferrié. *Rev. Inst. franç. Pétrole*, 1948, **3**, 263–277, 295–306.—An entropy–enthalpy diagram for air, covering the range 0–1500° C, has been developed. Thermodynamic calculations of adequate precision can be based on a knowledge of the H/C ratio (h) of the fuel, and the wt of air in the combustion mixture. The various factors involved in the calculations are considered in some detail. h has a marked effect on fuel performance, due not only to increased cal. val. of fuels with high h, but to the more favourable composition of exhaust gases for propulsive purposes in such cases. Assuming perfect combustion the most suitable fuel for aircraft use would have h = 0·12–0·13, *i.e.*, a cal. val of 9900–10,000 cal/g and d_{15} 0·87–0·88. V. B.

Gas Oil and Fuel Oil.

687. Smoke Rating Analysis. Effects of Smoking on Domestic Oilburner Efficiency. C. H. Burkhardt and R. Ulrich. *Fuel Oil & Oil Heat*, Feb. 1949, **7** (10), 50.—The effect of smoke on burner efficiency has been investigated. The main lines of research are :—

(1) to study, analyze, and provide statistical data on the effect of continual or running smoking on overall combustion efficiency;

(2) to determine the effects of heavy refractory fire brick and soft insulating fire brick in terms of smoke ratings on the cycle of the burner.

(3) to analyze effect of pump pressure cut-off in terms of the time taken by unit to come down to zero smoke rating.

Results showed there was no exact ratio of increase between stack temp and smoke rating, but stack losses were proportional to the smoke ratings.

It was found that heavy brick-chambered units required over twice as long to attain a balanced combustion condition with a fairly stable CO_2 reading, as those of soft brick. Graphs show that heavy brick will affect the starting smoking conditions, but the evidence is not absolute.

A comparison between two burners, one ordinary type and one fitted with a special cut-off valve, showed that the latter came down to zero smoke rating more quickly than the former. D. K.

Lubricants.

688. Progress in Science and Art of Lubrication. E. V. Paterson. *Petrol. Times*, 17.12.48, **52**, 1100.—Developments in the field of lubrication, including porous bushes, piston lacquering, and chain lubrication, are reviewed. References are appended. C. G. W.

689. Aircraft Lubrication. E. E. Turner. *Soc. Engrs Jnl.*, 1948, **39** (1), 9–45.—The general principles of lubrication of piston-type aircraft engines are summarized, and cold starting, oil performance and consumption, H.D. oils, and corrosion problems are discussed. Lubrication requirements of propellors, electrical equipment, controls, hydraulic services, and undercarriage mechanism are outlined, and the applications of lubricating greases indicated. Present practice in the lubrication of jet turbine engines and components is presented, and future trends in this direction are suggested. Appendices cover details of endurance tests for prototype piston engines with two-speed mechanically driven superchargers (Air Registration Board, British Civil Airworthiness Requirements) and details of petroleum products used for aircraft fuel, lubrication, and allied purposes with relevant British and U.S. specifications. J. G. H.

690. Oxidation Behaviour of Hydrocarbons. IV. Behaviour of Lubricating Oil on Oxidation in a Test Bearing. C. Kröger and A. Kaller. *Erdöl u. Kohle*, 1948, **1**, 352–365.—An apparatus is described consisting of a plain test bearing in a gas-tight housing whereby oxidn of lub. oil under operating conditions can be studied. Tests use 50 ml of oil and are carried out in an atm of O_2 with loads of 0–1·7 kg/cm² and at temp in the range 70–117° C, the amount of O_2 absorbed by the oil being measured. Five samples of oil (two synthetic, three mineral) were tested, having visc (50° C) 10·4–126·8 cp. Test duration is 10 hr. All volatile oxidn products, both condensable and non-condensable, were collected for examination. The bearing temp plays a more important part in the oxidn than the oil temp. Increase of load from 0·17 to 1·7 kg/cm² raises the temp coeff of the oxidn reaction (in the range 70–80° C) from 2·58 to 3·13. Tests on the oxidized oil show that whilst *d*, sap. val., neut. val., an. pt., and visc vary approx in proportion to the amount of O_2 absorbed, iodine val and n_D^{20} bear no relation to the degree of oxidn. Up to an absorption of 2000 ml O_2 the main volatile condensable oxidn products are water and lower fatty acids, their quantity being proportional to the O_2 absorbed; when more than two-thirds of the oil is oxidized the formation of volatile oxidn products, especially water, increases rapidly. The principal non-condensable oxidn product is CO_2; small amounts of CO and CH_4 are also formed. Of the two synthetic oils tested a hydrogenated oil was the more oxidn resistant, approximating in its general behaviour to the mineral oils examined. The influence of the bearing metal varied with the test temp; at 90° C the decreasing order of effectiveness of oxidn promotion was Pb, Cu, Sn, brass, Fe, whilst at 115° C it was Pb, Sn, Cu, Fe, Zn, brass, bronze. Pb was especially attacked by oxidized oil, as much as 1·5% being finely dispersed in the oil. Tests on additives showed tin oleate to be an oxidn cat, the most effective of the inhibitors examined was β-naphthylamine. The influence of load and friction on oil oxidn is less than that of temp and the cat action of metals. V. B.

691. Performance of Silicone Lubricants at High Temperatures. C. C. Currie. *Lubrication Engng*, Oct. 1948, **4**, 220–222.—The general properties of silicone compounds as high-temp lubricants are discussed, and the specific applications of the present range of silicone oils and greases are enumerated with operating data. It is emphasized that silicone lubricants were developed for specific uses and are not intended for general use where a conventional organic lubricant has proved satisfactory. J. G. H.

692. Silicone Lubricants. A. E. Williams. *Scientific Lubrication*, Jan–Feb., 1949, **1**, 10–13.—The advantages of silicone fluids as compared with conventional petroleum lubricants are indicated, and an account is given of American research on the application of dimethyl–silicone–polymer fluids to pressure systems. Advantages in the lubrication of bearings are enumerated, failure being encountered with certain metal combinations, particularly steel on steel. J. G. H.

693. Lubricating Oil Synthesis by the Alkylation of Naphthalene. H. Köbel. *Erdöl u. Kohle*, 1948, **1**, 308–318.—Synthetic lub. oils are manufactured by the Friedel–Crafts condensation of chlorinated Fischer–Tropsch naphtha (b.p. 280–320° C) with naphthalene using 1% of a suitable cat (not further specified). Data are given showing the effect on the quality and yield of lub. oil produced when using a similar naphtha from natural petroleum; xylene in place of naphthalene; the variation of the lub. oil properties with naphthalene–naphtha ratio; the effect of using Fischer–Tropsch fractions of varying b.p.; and the influence of the depth of chlorination of the naphtha. Chlorination is carried out at 60–100° C, whilst the condensation occurs rapidly (¼ hr) at 80–100° C to yield a Cl-free lub. oil. A flow-sheet of the production plant, which operated for 3 years at 3600 tons/p.a., is given. The reaction is carried out in solvent (150–220° C Fischer–Tropsch gasoline), the solvent–naphtha ratio being 2/1. The synthetic lub. oil is lime and clay treated and then vac distilled to yield 15–30% transformer oil, 25–60% turbine oil, and 25–60% cyl stock. The overall yield of oil is 87% on the total hydrocarbon charging stock. Investigations were made on the composition of the synthetic lub. oil by fractionation (0·05 mm) into cuts whose Raman spectra, mol. wt., and visc were measured. A series of β-*n*-alkylnaphthalenes with side-chains from C_1–C_{16} was synthesized, and the variation of visc and visc–temp relationship with length of side-chain determined. From comparison with this data and the other characteristics the composition of the synthetic lub. oil is considered to be 30–35% β- and 15% α-alkylnaphthalenes averaging C_{16} in the alkyl group, 10–15% α- + β-alkylnaphthalenes with C_9–C_{12} side chains, approximately 1% each of α- and β-alkylnaphthalenes with C_6–C_8 side chains, 1% of *iso*-paraffins, 2% of *n*-paraffins (C_{14}–C_{18}), and 30% of an undistillable viscous residue of unknown constitution. Inspection data on a range of nine industrial oils (transformer oil to cyl stock) is given showing that they possess high sp. gr. (0·907–0·972) good V.I., low pour point, high oxidn resistance, and favourable properties generally. The oxidn resistance is assessed by the rise in C.R. (Con) after air blowing (172° C, 12 hr, 10 litre air/hr). Friction (Thoma tester) and engine tests (both I.C. and superheated steam engines) show the synthetic oils to be in every way equal or superior to conventional petroleum lubs. The superheat temp could be raised higher with the synthetic oil than with the petroleum lub. used for comparison. V. B.

694. Light Weight Cone for Penetration of Soft Greases. L. C. Brunstrum. *A.S.T.M. Bull.*, Oct. 1948, **154**, 66–67.—Results of the A.S.T.M. and N.L.G.I. Committees' deliberations during the period 1941–45 on penetration methods for the measurement of consistency of soft greases by means of a light-weight cone are summarized. J. G. H.

695. Some Observations on Factors Affecting the Structure of Calcium Soap Lubricating Grease. L. W. Sproule and W. C. Pattenden. *Canad. J. Res.*, 1948, **26F** (11), 465–468.—The effect of the presence of water and of the shearing forces present during manufacture on a calcium-soap dispersion in mineral oil has been determined by electron-microscope observations. The addition of water to stabilize the dispersion was found to orientate the soap particles from minute, nondescript form to fibres having a wavy, loosely coiled appearance. The shearing action of mixing caused the fibres to assume a spiral or twisted form. D. F. J.

696. Colloidal Graphite. E. A. Smith. *I.P. Review*, Nov. 1948, **2**, 332.—When a bearing is lubricated by oil containing colloidal graphite, some of the particles become adsorbed on the metal and form a graphoid surface, which cannot be washed off by oils or petrol. The main function of the graphoid surface is to reduce static friction, and to offset the effects of boundary conditions. The adsorptive capacity leads to improved oilspread over surfaces like chromium, which are difficult to wet, and ensures a residual oil film for longer periods under abnormal conditions of lubrication. Colloidal graphite added to oil will offset seizure, reduce cylinder wear, and, in petrol, reduce corrosion of piston-rings.

Other applications of graphite as an additive are for running-in, for intermittent lubrication (*e.g.*, aircraft undercarriages), metal-working operations, and lubrication at high temperatures (*e.g.*, conveyors of furnaces).

There are six literature references. W. M. H.

Bitumen, Asphalt, and Tar.

697. Airport Runway Base Construction with Emulsified Asphalt and Sand. V. L. Taylor. *Rds & Streets*, Jan. 1949, **92** (1), 62.—A base course for Gulf Coast airport was hurriedly prepared in bad weather, using emulsified asphalt and silty sand. The foundation, comprising silty loam, silty sand, and impervious clay in turn, was difficult to drain and became soggy in wet weather. An 8-in base course was prepared as follows :—

Imported sand was mixed with the surface material so that the resulting mixture had a minimum stability of 30 p.s.i. at a 1·75% moisture content. This mixture, frequently graded, was treated at the rate of 7·5 gal/sq. yd with a doped 60–65% bitumen emulsion of viscosity 20–100 sec S.F. at 77° F, giving 4½–10% residual bitumen content. The mixture had a stability of 160 p.s.i. The speed of application was 5000 sq. yd per 10-hr day. R. H.

Special Hydrocarbon Products.

698. British-Made Carbon Black. C. L. Taylor. *Petrol. Times*, **53** (1341), 10.—Factories are shortly to be erected in this country for the manufacture of carbon black. Plants erected for manufacture of gas from coal tar produced a residue of carbon paste. During war-time the carbon was recovered in a substantially dry form, and in this form has been used in the rubber industry. This type of carbon "Seval," as a medium thermal black or soft carbon, has a low reinforcing value, but is easily processed and can be highly loaded into the rubber stock. The type of carbon black produced depends on the process used and not the fuel charged. The process used involves injection of fuel into a vessel at high temp, gasifying it in an open upper chamber, and contacting the gas with the hot firebrick surfaces to obtain a catalytic effect. The fuel is thus cracked into carbon and hydrogen. The gas with carbon in suspension is passed through cyclones where about 80% of carbon is removed and then water washed to remove the remainder. Details of the equipment, process, and difficulties encountered are described. C. G. W.

699. Role of Sulphur in Cutting Oils. C. Jungblut. *Rev. Inst. franç. Pétrole*, 1948, **3**, 307–312.—Experiments on producing (in an emergency) a cutting oil from fuel oil indicate that a satisfactory product can be obtained by adding 6% of S at a temp of 200° C and heating for 30 min. The oil thus produced contains approx 1·5% of "active" S. Reaction temp is important; any marked excess over 200° C leads to loss of S and an unsatisfactory oil. Analysis of steel cuttings (made with such an oil) shows them to have a higher S content than the bulk of the metal, indicating sulphide formation at the surface. "Active" S is determined by dissolving 10 g of oil in benzene to give 20 ml of solution, centrifuging to remove impurities, taking 4 ml of the solution, adding 0·5 g of precipitated Cu, and maintaining at 100° C for 30 min with agitation. The metal is then separated by centrifuging, washed with benzene and dissolved in conc HNO_3, precipitating the sulphur as sulphate. Precipitated Cu is prepared by adding Al to a N solution of $CuSO_4$. Results show good correlation between content of "active" S thus determined and workshop performance of the oils. V. B.

700. Dry Ice from Oil-Well Gas. C. D. Gard. *Oil Gas J.*, 6.1.49, **47** (36), 56.—The Santa Maria, California, extraction plant of the Union Oil Co., is described. The plant processes 30,000 million cu. ft./day natural gas, and employs a 20% solution of monoethanolamine with water. H_2S is extracted, using a soda-ash solution in which is suspended iron oxide, and the sulphur will be recovered. From the vented CO_2 stream some 56 tons daily of dry ice is produced, after purification, compression, liquefaction, and dehydration. Three presses, each making 20 tons of dry ice per day produce 240-lb slabs which are cut and wrapped. Specially constructed dry-ice cars transport the product. G. A. C.

701. Low Pressure Aerosols—Their Efficiency in Relation to Formulation and Particle Size. R. H. Nelson, R. A. Fulton, J. H. Fales, and A. H. Yeomans. *Soap and Sanitary Chemicals*, Jan. 1949, **25** (1), 120.—Tests were carried out to determine the effect of varying the ratio of the volatile to non-volatile ingredients on particle size of the aerosol, and on its insecticidal efficiency and gauge pressure. Insecticidal efficiency was determined in tests against the house fly, made in a Peet–Grady Chamber. To determine particle size of aerosols, samples, sprayed through a 0·017-in capillary nozzle were collected on oleophobic-coated microscope slides by electric precipitation, and the sizes of the particles measured.

Five series of formulations were tested. Those of each series contained equal quantities of insecticidal ingredients including D.D.T. and pyrethrum, but the ratio of volatile to non-volatile was changed by altering the amount of solvent.

Results showed that in each case the gauge pressures decreased with increasing non-volatile content. Insecticidal efficiency in general showed negative correlation with non-volatile content and particle size, but results indicate that the best formulations appear to be those with 10 or 15% non-volatile constituents, *i.e.*, a 15–85 ratio. It is desirable, from a health point of view, that the deodorized kerosine content be held at a minimum.

There are five literature references. W. M. H.

702. Application of Dormant Oils as Mists. J. L. Brann, Jr, A. W. Avens, and R. W. Dean. *J. Econ. Ent.*, 1948, **41**, 180.—Experiments carried out in six apple orchards in 1946 and 1947 showed that dormant oils may be applied efficiently and economically as mists. The most satisfactory concentration was a 25% emulsion, and the amount of oil deposited was found to be correlated with the actual quantity of oil applied rather than concentration in mist.

In comparison with conventional sprays, the method was found to need only one-half to one-third the amount of oil to produce an equivalent oil deposit.

Where population of red-mite eggs was very dense it was found difficult to obtain an effective oil deposit, but control was similar to that obtained from a conventional spray when deposits were comparable.

There are three literature references. W. M. H.

703. Mode of Action of Petroleum Oils as Ovicides. E. H. Smith and G. W. Pearce. *J. Econ. Ent.*, 1948, **41**, 173.—The effect of oil on the respiratory rate of eggs of the Oriental Fruit moth was found to be a marked reduction in activity, followed by a quick recovery to a rate still below normal. The degree of reduction was related to dosage, and eggs at various stages of development showed variation in susceptibility, the oldest being least susceptible.

A precise relationship was found to exist between duration of oil-and-egg contact and the hatch which followed. This was demonstrated by removing oils from eggs at intervals after treatment.

It is suggested that eggs produce a toxic gaseous metabolic product during development, and that the action of ovicides is to prevent the elimination of this toxic product, so that it accumulates until it becomes lethal.

There are eight literature references. W. M. H.

704. Two Years of Experience with Mist Blowers for Control of Apple Pests. P. Garman. *J. Econ. Ent.*, 1948, **41**, 213.—It is concluded that mist blowers can give suitable pest control, but that not enough is known about their use as yet to recommend them in place of the conventional sprayer.

Toxicants used in experiments included lead arsenate, sulphur, and white mineral oil.

Advantages of the mist blower are: (1) ease of operation; (2) large number of trees sprayed with one filling; (3) lack of removal of previous sprays; (4) feasibility of spray and dust applications with one machine; (5) speed of operation.

Disadvantages are: (1) difficulty of getting mists to settle on foliage in moderate winds; (2) insufficient agitation of concentrate; (3) it is not easy to obtain complete cover of all parts of tree; (4) some nozzles used are unsuitable for application of concentrates, and all must be improved. W. M. H.

705. Toxicology of 4, 6 Dinitro-o-cresol as an Aphid Ovicide. P. J. Chapman and A. W. Avens. *J. Econ. Ent.*, 1948, **41**, 190.—The toxicity of D.N.O.C. in aqueous solution was tested under controlled conditions against eggs of twenty-two species of aphids. Results showed that susceptibility varied from 0·003 to 0·05% effective dosage, *i.e.*, a 95% kill.

Correlation was found between susceptibility to D.N.O.C. and time of egg hatching, but there was little difference in susceptibility of eggs at various stages of embryonic development. Eggs hatching early were much more susceptible to toxicant than those hatching late.

Solutions of sodium, calcium, ammonium, and magnesium salts were found to be as effective as the acid itself.

There are fifteen literature references. W. M. H.

706. Determination of 4–6 Dinitro-o-Cresol on Bark Surfaces and some of its Applications. A. W. Avens, P. J. Chapman, and G. W. Pearce. *J. Econ. Ent.*, 1948, **41**, 432.—A method has been developed for the determination of the quantity of D.N.O.C. deposited on plant surfaces in spraying when used as an aphid ovicide. The toxicant is removed with petroleum ether, converted to the yellow sodium salt, and the colour intensity is measured with a photo-electric colorimeter.

Wide variations were found in the amounts of deposit on bark surfaces of different plants sprayed with the same mixture, and these results are discussed. Wetting agents were found to influence the distribution of the toxicant, but not the rate of kill. W. M. H.

707. Persistence of D.D.T. and Benzene Hexachloride in Soils. M. S. Smith. *Ann. Appl. Biol.*, 1948, **35**, 494.—A study has been made of the length of time for which D.D.T. and benzene hexachloride will persist in soils. 2% solutions of both insecticides were mixed with various acid and alkaline soils, and either exposed outdoors or subjected to controlled leaching in the laboratory. Determinations were made periodically of residual insecticide, chloride content of soil, and pH.

Both D.D.T. and benzene hexachloride were found to be very stable in soil, 95% of the former and 80% of the latter being recoverable after 18 months, during which time very little chloride was leached. In both cases the residual insecticide was very toxic to wood-lice; eighteen months after treatment the benzene hexachloride prevented root growth of germinating seeds, though root growth was normal in D.D.T. soils.

There are fourteen literature references. W. M. H.

708. The Contact Toxicity of a Number of D.D.T. Analogues, and of Four Isomers of Benzene Hexachloride to *Macrosiphoniella Sanborni* and *Oryzaephilus Surinamensis*. K. A. Lord. *Ann. Appl. Biol.*, 1948, **35**, 505.—Twenty-three analogues of D.D.T. and four isomers of benzene hexachloride have been compared with D.D.T. as contact insecticides against the two species named, using a direct-spraying technique, and examining the data by probit methods.

Probit lines for D.D.T. analogues varied both in position and slope, and their toxicity appeared to be related to molecular weight, the greatest toxicity occurring in molecular weight range 300–450, while variation of slope in probit lines was related to molecular volume.

Probit lines for benzene-hexachloride isomers varied in position, but not in slope.

Theories of toxicity of both insecticides are discussed, and a physico-chemical mechanism of toxic action is put forward. This implies that intensity of action is

dependent on physico-chemical properties, and toxicity is dependent on the molecule as a whole.

There are forty literature references. W. M. H.

709. Control of Mites on Apple Trees Sprayed with D.D.T. N. S. Hough. *J. Econ. Ent.*, 1948, **41**, 207.—Three series of tests were carried out on European red mite control, the most effective toxicants being di-(4-chlorophenoxy)-methane, dioctyl phthalate, and parathion. Parathion also gave good results in control of codling-moth larvæ. Other substances showing promise, but not so effective were : *n*-dodecyl-2-thiazolinyl sulphide, hexaethyl tetraphosphate, and tetraethyl pyrosphosphose.

Two literature references are given. W. M. H.

710. An Account of Some Solid Properties of Petroleum Waxes in terms of their Composition. S. T. Minchin. *J. Inst. Petrol.*, 1948, **34**, 542–582.—The composition of petroleum waxes and their physical properties are discussed with reference to the pure *n*-paraffins, and this is followed by a study of the hardness of petroleum waxes. The influence of oil and soft wax on the settling points and their plasticizing action are shown, and finally a hypothesis is presented concerning the manner of solidification of wax mixtures. A. R. W. B.

Miscellaneous Products.

711. Catalytic Dehydrogenation of Normal Butenes to Butadiene in the Presence of Steam. L. H. Beckberger and K. E. Watson. *Chem. Engng Prog.*, 1948, **44** (3) 229–248.—Details are presented of results obtained in a small pilot plant designed and constructed for kinetic studies of the catalytic production of butadiene by dehydrogenation of normal butenes in an atmosphere of steam over the "1707" catalyst of the Standard Oil Development Co. Rates of the principal primary and secondary reactions, both catalytic and non-catalytic, established over considerable ranges of conditions, are related to controlling conditions in rate equations employed to predict the performance of commercial-scale reactors. Results so obtained register close agreement with the performance of operating plants. J. G. H.

712. Carbon Black Shifts to Furnace Process. C. A. Stokes and R. E. Dobbin, *Chem. Ind.*, 1949, **64** (1), 40.—Investigation during latter years has shown that particle size of carbon black is not necessarily the controlling factor in reinforcement of synthetic rubber. This discovery led to a greatly increased demand for furnace black, the popularity of which has been subsequently enhanced by the production of "cold-rubber" tyres reinforced with furnace black. Road life is 25% longer than similar tyres reinforced with channel black.

From the production point of view also it is being found that furnace black is more economical than channel black to manufacture, quite apart from the various advantages which it shows over channel black when used as a reinforcing agent in rubber products.

In this article are included a list of manufacturers and trade names of carbon blacks and also a classification of carbon black for rubber. O. M.

713. Catalytic Dehydrogenation of Ethylbenzene. R. W. Wenner and E. C. Dybdol. *Chem. Engng Prog.*, 1948, **44** (4), 275–286.—Laboratory and pilot-plant data are presented on the production of styrene by the dehydrogenation of ethylbenzene using two types of catalyst, one requiring frequent regeneration and operating in the presence of substantially undiluted hydrocarbons, the other of a continuously regenerating type, operating in the presence of steam. Materials, apparatus, and operating procedures are discussed, and the data obtained is applied to the design of a commercial converter system. J. G. H.

714. Bouveault Reduction of some Natural Glycerides. 2. G. Jacini. *Chim. e Industria*, 1948, **30**, 199.—In continuation of former work (see *Chim. e Industria*, 1947, **29**, 172), the results of a series of reductions carried out by the action of metallic sodium and butyl alcohol at 120° C on various glycerides and esters of higher alcohols are given. These confirm the value of the method for obtaining unsaturated higher alcohols. D. H. McL.

715. Protective Grease for Threads Exposed under Corrosive Conditions. M. Cohen, A. C. Halferdahl, and I. E. Puddington. *Canad. J. Res.*, 1948, **26F** (8), 347–348.—A steel plate ¼-in thick was drilled and tapped to take ¼-in bolts, and the bolts and nuts treated with various oils and greases. After severe corrosion tests, the bolts treated with an inhibited aluminium-stearate grease were the most easily turned. The composition of this grease was: 2% zinc chromate, 5% graphite, 7% aluminium stearate, and 0·02% stearic acid, in an acid and clay-treated Columbia Distillate having a visc *ca* 90 S.S.U. at 210° F. D. F. J.

716. A Study of the Effect of a Petroleum-Type Plasticizer on Various Furnace Blacks in Natural Rubber. R. E. Elliott and H. A. Winkelmann. *India Rubber World*, 1948, **119**, 338.—The effects are described of a petroleum-type plasticizer on the processability and physical properties of a natural-rubber compound reinforced with new furnace blacks. There are no adverse effects on the general physical properties of the compounds. The effect on ageing of a high-boiling aromatic hydrocarbon plasticizer of the type described is generally beneficial. It does not appreciably alter the curing characteristics of the compounds. Processability of the various reinforcing furnace blacks is improved, but their comparative compounding properties are unaltered. C. N. T.

717. Protective Coatings. H. Silman. *Auto. Engr*, Nov. 1948, **38** (507), 441.—The nature of the materials used in automobile bodies and fittings makes corrosion protection of major importance in the industry.

Chromium- and nickel-plating are most widely used for protection coupled with decoration. In the case of nickel, the high cost of polishing after plating can be eliminated by using bright nickel-plating, a process which depends largely on the obtaining of a high lustre on the base metal.

Bright copper undercoats can be obtained from the Du Pont bath containing a cyanide solution with sodium thiocyanate and a brightening agent—similar results are obtainable from solutions containing diethylene triamine. Composite copper-nickel coatings show no advantage over pure nickel deposits.

Plating of die-castings is carried out from dull or bright nickel solutions with a copper undercoat. Thicknesses of both copper and nickel coatings are critical; for instance, there is always a tendency for copper to diffuse into zinc-base-alloy castings, and so the copper coating must be adequate or there may be poor adhesion.

Aluminium-alloy die-castings require special plating treatment but it is believed that they will not be inferior to zinc-base castings. Their lower cost is an advantage.

Pretreatment of metal prior to painting is most important. In general practice, degreasing by hot alkali or solvents is followed by phosphate treatment. For maximum effectiveness the phosphate coating must consist essentially of tertiary phosphates. This coating provides a key for the paint coating and prevents lateral spread of corrosion beneath the paint film. Phosphatizing of steel which has been previously zinc-coated yields a very good anti-corrosion basis for organic coatings.

In connexion with the use of high-temp stoving black enamels the new process of electrostatic detearing has overcome many of the disadvantages of this type of finish.

The application of primer (oil-based synthetic enamels) is of particular interest in view of the possibility of coating complete car bodies by the dipping process.

Finishing involves the application of at least two highly pigmented surface coats followed by a cellulose or stoved synthetic enamel. O. M.

Engines and Automotive Equipment.

718. Some Aspects of Power Plant Development. E. W. Still. *J. Roy. Aero. Soc.*, 1948, **52**, 767.—The author covers aspects of power-plants concerned with passengers' safety and comfort, and the paper is grouped under the general headings of: *a*)) design regulations; (*b*) reliability; (*c*) fire prevention; (*d*) noise; (*e*) vibration. I. G. B.

719. Leonides Variants for Helicopters. Anon. *Aeroplane*, 11.2.49, **76**, 153.—A description is given of a new power-plant for helicopters, and the usual informative cut-away drawing is included. I. G. B.

720. "Universal" [Marine] Diesel Engine. G. T. Lugt. *Gas Oil Pwr*, 1948, **43**, 343–345.—The proposed "universal" engine must be the most economical from considerations of weight, size, fuel and lub.-oil consumption, overhauls, simplicity, reliability, and regularity in service. The author considers that these are best fulfilled by the two-stroke engine, pressure-charging, single-acting, and burning boiler oil as fuel. Each cylinder is made self-contained by operating the fuel pumps and exhaust valves from the piston-compressor shaft, which in turn is operated by the reciprocating motion of the crosshead. By this arrangement space between cylinders is saved and the weight per b.h.p. is 40–45 kg.

An experimental engine having two cylinders of 600 mm diameter and 1100 mm stroke developed 1200 b.h.p. at 130 r.p.m. It ran for 2 weeks without trouble on boiler fuel of 1400 sec Red. I. H. C. E.

721. Two-Stroke Dual-Fuel Engines. Anon. *Gas Oil Pwr*, 1948, **43**, 422.—These Nordberg engines have three different cylinder sizes, of which the largest is 29 by 40 in. They are of the loop-scavenge form and range in output from 1250 to 8500 b.h.p.

The gas supply is independently compressed and stored at 1100 p.s.i. in bottles from which it is admitted to individual valves in the cylinder-heads. A small quantity of fuel oil is injected with each gas charge. The valves are timed by a hydraulic control mechanism, and injection extends over about 25° of crank travel.

It is claimed that outputs on fuel oil and on gas are equal. In tests made on the 21-in-cylinder engine the heat supplied at full load per kW hr amounted to 1000 B.Th.U. from the pilot oil and 9500 B.Th.U. from the gas. H. C. E.

722. American General-Purpose Engine. Anon. *Gas Oil Pwr*, 1948, **43**, 421.—This Lima Hamilton Corp. four-stroke engine, suitable for marine, stationary, or railway use, is available with six or eight cylinders, which have bore and stroke of 9 and 12 in respectively, with either turbo-charging or natural aspiration. The eight-cylinder pressure-charged unit develops 1200 b.h.p. at 950 r.p.m.

The engine is lubricated on the dry-sump principle. The forged aluminium pistons are oil-cooled, and the connecting-rods are drilled to carry lub. oil to the gudgeon pins. The turbo-charger takes its lubricant from the engine system. H. C. E.

723. Alternative-Fuel Engines for Oil Pumping. Anon. *Gas Oil Pwr*, 1948, **43**, 369.—These National six-cylinder engines have 6 by 8¼ in cylinders and piston speeds of 1520 ft/min at 1075 r.p.m. Direct injection is provided; the fuel consumption at full, ¾, and ½ load is 0·38, 0·39, and 0·43 lb oil/b.h.p.hr. respectively, and on natural gas 7000, 8000, and 11,000 B.Th.U./b.h.p.hr. respectively. In the tropical conditions under which the units operate, viz., at 35° C and 95% Relative Humidity, the 12-hr rating at 1075 r.p.m. for oil of 19,000 B.Th.U. is 149 b.h.p. and for gas of 800 B.Th.U. per cu. ft., 142 b.h.p. The engines drive horizontal duplex pumps, each of which delivers 37 cu. m./hr of crude oil against a working pressure of 1000 p.s.i. H. C. E.

724. Oldsmobile's High Compression Engine. J. Geschelin. *Auto. Ind.*, 1948, **99** (12), 30–33, 58.—Details are presented of the new eight-cylinder, 303 cu. in. V-type engine, developing 135 h.p. with 7·25 to 1 compression ratio, so designed as to permit the C.R. to be increased to 12·5 to 1 without major modifications. A series of sectioned drawings are included. J. G. H.

725. The B.I.C.E.R.A. Flow Meter for Measuring the Fuel Consumption of Internal Combustion Engines. W. P. Mansfield. *Mech. World*, 3.12.48, **124**, 627.—Conventional flow meters of the orifice type suffer from the defect that their calibration varies significantly with small changes in temp of the fuel. The pipette method is unsatisfactory from several aspects including variations of sp. gr. and in volume of the instrument, change in feed pressure to the engine due to reductions in head of fuel contained in the instrument, etc.

The instrument under discussion overcomes several of the difficulties mentioned above. Instead of measuring volume it utilizes a compact form of weighing machine and, in addition, the head of fuel in the instrument is kept constant by allowing it to ascend at a controlled rate. The method of calibration is given together with a detailed description of the meter. O. M.

726. New Engine Test Bed. Anon. *Petrol. Times*, 17.12.48, **52**, 1094.—A spring-mounted structure, prefabricated by electric welding from standard steel sections, has been developed. To give requisite mass the structure is filled in with concrete. Such structures effect a considerable saving in time and some saving in expenditure over traditional engine beds. C. G. W.

MISCELLANEOUS.

727. Corrosion Inhibition with Chromate. M. Darrin. *Oil Gas J.*, 13.1.49, **47** (37), 83.—This is the introduction to a new series, and gives general data on the use of chromates and bichromates in combating corrosion.

The use of chromate inhibitors is well established, and the corrosion-inhibiting value of a soluble chromium compound is proportional to its hexavalent chromium content. Chemically, bichromates are more reactive than chromates, and are consumed more rapidly, but choice is largely one of cost versus convenience. Bimetallic corrosion is difficult to combat, but chromates are successfully used.

Aeration creates corrosion conditions, but chromate in solution will negative these.

Potassium salts should be used if relative-humidity conditions are over 52%.

A table gives practical dosages for various chromates to permit costing.

Special reference is made to physiological effects of bichromate in particular to contact with the skin, which causes ulceration. A formula for a salve is given.

G. A. C.

728. Corrosion and Fouling. Anon. *Paint Technol.*, Nov. 1948, **13** (155), 461.—This article is a summary of two papers, (*a*) "The Corrosion and Fouling of Ships," by G. D. Bengough and V. G. Shepheard (*Trans. Institution of Naval Architects*, 1943, **85**, 1–34); (*b*) "Hull Corrosion and Fouling," by G. D. Bengough (*Trans. Institution of Engineers and Shipbuilders*, 1943, **39**, 183, 123.)

A common cause of corrosion is mill scale; this is electropositive to steel. In sea-water, cells are set up, and local pitting or widespread corrosion occurs according to the area of the cathode.

The success of any protective covering system depends upon its adhesion to the metal. Three types of pre-treatment are possible: (1) acid pickling followed by weathering; (2) weathering only; (3) weathering following by immersion in water.

Anti-corrosion compositions may work by: (*a*) impermeability; (*b*) electrochemical protection; (*c*) inhibitive action.

Fouling affects the performance of ships by increasing the skin-frictional resistance, thereby reducing speed and increasing fuel consumption. The stages in fouling are formation of a slime layer consisting mainly of bacteria and with some diatoms. An algal layer then forms and simultaneously an animal layer.

Factors affecting fouling are the breeding seasons of the plants and animals and the period of stay in port. The fouling characteristics of ports vary widely. Comparative tests were made on typical commercial three-coat anti-fouling systems. Results showed that on pickled panels most failures were due to rusting, but on repainted panels failures were largely due to fouling, except where paints had short lives.

Poisons used in anti-fouling compositions are briefly considered. Mercury was found to be the most effective poison for animal fouling.

Brief discussions follow the original papers, and these include an account of work done in the U.S.A. on cracking rates of anti-fouling paints and the practices of flame de-scaling and wet sandblasting. D. K.

729. Cost-imating. Estimate of a Fractionator. W. L. Nelson. *Oil Gas J.*, 6.1.49, **47** (36), 93.—No. 12 in this series provides a worked-out example for costing a particular fractionator, and a table itemizes the account.

A second table provides a quick estimate of tower costs, for tower diameters ranging from 3 to 14 ft, and for ¼-in, ⅜-in, and ½-in thickness, for both 8 and 30 plates.

G. A. C.

730. Cost-imating. Simplified Cost Estimates. W. L. Nelson. *Oil Gas J.*, 20.1.49, **47** (38), 97.—No. 14 in the series discusses methods of estimating costs of a refinery.

Tables show average break-up of plant costs, and to illustrate prices in foreign lands, the extra costs of one South American refinery. Stress is laid on the fact that simplified costs are not as dependable as detailed estimates. G. A. C.

731. Gas-Processing Industry is Still Enlarging Productive Capacity. Anon. *Oil Gas J.*, 27.1.49, **47** (39), 207.—A survey of active natural-gas processing-plant projects is given.

Tables show operating company, location, capacity, status, completion schedule, and contractors. G. A. C.

732. Education for the Lubricant Industry. W. Davey. *Scientific Lubrication*, Jan.–Feb. 1949, **1**, 5–8.—The desirability of a wide availability of knowledge of the principles and practice of lubrication is stressed, and the special requirements of the general public, sales group, technician group, lubrication scientists, and the teaching group are discussed with indications as to how these needs may be met. American trends in training are reported, and suggestions for specialist training in this country are put forward. J. G. H.

733. Calculation of Viscosity of Oil Blends. M. Roegiers and L. Roegiers. *Petrol. Times*, 17.12.48. **52**, 1091.—This article is an extract of the practical conclusions reached in an original paper by the authors on the viscosities of ideal mixtures. An important development of the work is an abacus for the calculation of viscosities and blending factors of two-oil blends. The abacus consists of two elements, a triangle of metal, the base graduated as a composition scale, the other two sides in viscosity units, and a ruler graduated in viscosity units. Manipulation of the abacus to obtain viscosities is illustrated by an example. C. G. W.

734. Refinery Building Program is Largest in Industry's History. R. B. Tuttle. *Oil Gas J.*, 27.1.49, **47** (39), 201.—A survey of active refinery expansion projects is given. Tables show operating company, location, capacity, status, completion schedule, and contractors. G. A. C.

735. World Outlook . . . Petroleum Supply and Demand. A. D. Stewart. *World Petrol.*, 1949, **20** (1), 42–45.—Remarkable progress has been made in the petroleum industry in spite of supply difficulties encountered in reconstruction and expansion. A substantial improvement has taken place during 1948 in the world demand–supply position for petroleum and its products. The situation is reviewed on a regional and global basis. E. B.

736. Absorbent Earth Industry. A. Ackermann. *Chim. et Ind.*, 1949, **61**, 29–37.—A brief summary of the history of bleaching earths, followed by a discussion of the industry's main present features. Analyses of naturally occurring earths are given, and the factors favourable to activation considered; one of the latter is a straight moisture-loss curve in the range 100–1000° C. Methods of production of natural and activated clays are outlined; acid-treatment conditions can be critical, *e.g.*, for a Bavarian clay 37% (wt) of HCl gives an active product, but even small variations on either side of this proportion cause a rapid drop in bleaching power. The testing of bleaching earths and their use in various industries is finally briefly considered. V. B.

BOOK REVIEWS.

Short History of the Art of Distillation. R. J. Forbes. Leydon: E. J. Brill, 1948. Pp. 405.

Professor Forbes gives a critical account of the historical development of distillation in this book, and incidentally also a history of the development of chemical thought and of chemical technology. It is interesting to note that he considers that the distillation of alcohol was not used until the eleventh century A.D., when the process was apparently discovered in the North of Italy, thus disproving another Irish legend, namely, that alcohol was first manufactured in Ireland at a much earlier date. He summarizes the early literature confirming that the distillation process itself was first used amongst the Alexandrian Chemists in the first century A.D.

The book is well illustrated with a very large number of illustrations taken from the literature throughout the whole period covered from Hellenistic manuscripts up to about 1860. The first bubble cap and bubble-cap tray appears to have been developed by Collier about 1810.

There are a few spelling errors through the book, which in some cases, as for example Engeland for England, appears to be due to the fact that the book is printed in Holland. Professor Forbes states that Kunckel had taught chemists in his Ars Vitraria to blow glass, but we find previous to Kunckel's time that glass apparatus was extensively used by chemists of the period, as for example, in French "Art of Distillation" (1651), where in addition blow-pipes are described for melting glass. Professor Forbes also states that there is little published in England on chemical technology between the sixteenth century and the early nineteenth century, thus disregarding the whole of the early work of the Royal Society, which initially was especially interested in the methods of manufacture of chemicals and other products. Chemical technology is also considered in such books as Merret's "Art of Glass" (1662), Clark "Natural History of Nitre" (1670), and particularly Houghton's "Husbandry and Trade Improved" (1692–1703), and again late in the nineteenth century in Watson's "Chemical Essays."

Professor Forbes cites the writings of Al-Dimaski (1256–1327) as giving the earliest reference to the industrial distillation of crude petroleum.

Professor Forbes' book is the product of a very careful and painstaking consideration of the literature on the art of distillation, leading to a number of new conclusions, and it is certainly by far the most complete book that has yet been published on this subject. F. H. G.

The Elements of Coal Chemistry. D. J. W. Kreulen. Rotterdam: Nijgh and Van Ditmar N.V., 1948. Pp. 204.

The present book, in a most attractive form, is to be regarded as the second edition of the author's work "Grundzüge der Chemie und Systematik der Kohlen," first published in 1935, and English-speaking students will be grateful for the opportunity of studying, in a more familiar language, the work of such a recognized authority as Kreulen.

The subject of coal chemistry is extremely wide and requires for its full appreciation a specialized knowledge of many subjects, so that the task of selection, from the enormous relevant literature, of the material to be included in a 200-page monograph is formidable in the extreme. Few writers have had the long experience in this field enjoyed by the author, and none is better able to assess the value of the various items of published information which go to form the literature of the subject. No other work in the English language by a single author reviews so many different phases of coal chemistry as does the present.

Whilst acknowledging the value of the work, the reviewer was left with a sense of slight discontinuity and a desire for a somewhat fuller exposition of several topics. Moreover, he regards certain omissions as detracting seriously from the value of the book, *e.g.*, the work on oxidation and extraction by Bone and his colleagues receives no mention, while the work on hydrogenation carried out at the U.S. Bureau of

Mines is discussed in a manner which gives little indication of the scope and emphasis of the investigations.

Nevertheless, the book is a valuable addition to the English literature of coal chemistry, but its usefulness would be enhanced by the addition of an index.

L. H.

Submarine Geology. Professor F. P. Shepard. New York: Harper & Bros., 1948. Pp. xvi + 348.

This book is a summary and review of the vast amount of data accumulated during the past quarter of a century, following on the introduction and development of echo-sounding and coring devices, geophysical prospecting, bottom photography, etc. Evidence is accumulating rapidly, and the results of the recent expedition of the *Albatross*, when available, will throw much new light on the configuration, rocks, and sediments of the ocean floor.

Modern exploration has dispelled the academic myths of a smooth and gently sloping continental shelf; a decreasing gradation in the texture of sediments when traced across the shelf; and an ocean floor consisting mainly of a vast monotonous plain of mud and ooze. The shelf shows many topographical features, such as terraces, ridges, hillocks, troughs, and basins, and the wide shelves off glaciated regions show distinctive features which are precisely those of the adjoining lands. Exposed rock, gravels, sands, silts, and muds are distributed very irregularly on the shelves. In many cases, muds are deposited fairly close to the shore and sands further out on the shelves; striking examples of this arrangement are found off the coasts of South China, South America, and the west coast of India. The rule is that the highest parts of the shelf are either devoid of sediment or covered with coarse sediment, that muds and silts are deposited in the troughs and basins, and that sands occur at intermediate levels.

Much accurate stratigraphical and structural data respecting the shelves will be revealed by geophysical prospecting and drilling for petroleum. For example, a well drilled by the Standard Oil Company near the outer shelf-edge opposite Cape Hatteras encountered Cretaceous beds at 2000 ft. A well-known American petroleum geologist has expressed the opinion that there is considerably more petroleum per square mile beneath the shelves than within the adjacent lands.

The continental slope is the most striking relief feature of the lithosphere, and was probably formed by recurrent faulting at the junction of the light continental and heavy oceanic segments of the earth's crust. The upper portions are usually rocky, but large rivers carry sediment to the lower parts of the slope, and off large deltas the whole slope is covered with sediment.

The book is unique for its descriptions of world-wide submarine canyons which have been cut back deeply into the shelves. The canyons are remarkably like land canyons, and many are at least a mile in depth. Many have rocks exposed on the walls, and fossils obtained from samples range mainly from the Cretaceous to the Pliocene. Geophysical work indicates the presence of older formations resting on basement rocks. In two cases the canyons have been cut, at least partially, through granite. They are related to river mouths and valleys on land, and show a river-valley pattern with numerous tributaries. Indeed, the author makes out a strong case for his conclusion that the canyons are river systems. He controverts other hypotheses as to their origin, and limits himself to the suggestion that sea-level was lowered about a mile by withdrawal of the water to form the ice-sheets of the Pleistocene. This suggestion would seem to be unacceptable, as it would require an even but impossible spread of ice more than four miles thick, or an uneven spread with maximum thicknesses of ten to twelve miles.

The very convex floor of the ocean is, of course, concave to the mean curvature of the earth. Excluding adjacent seas, the Pacific has a mean depth of 2340 fathoms, the Atlantic 2150 fathoms, and the Indian ocean 2180 fathoms; relative depths which do not support the common belief that the Pacific rests on an unusually heavy basement.

The ocean floor is very rugged, and modern exploration by echo-sounding suggests that the degree of known ruggedness is proportional to the amount and accuracy of the data. As regards deposits, the author states that Red Clay consists of fine material carried far out to sea in suspension from the land or continental shelves.

However, the *Albatross* expedition found layers of meteoric material in sediment cores, and from these it is hoped to date periods of high meteoric frequency. On the basis of the assumptions that the ocean basins are permanent and that deposition of Red Clay, and of various organisms during their range in time, has been continuous and at a uniform rate, then a thickness of more than two miles of Red Clay, and more than half a mile of Globigerina Ooze, would have been laid down. The present rugged topography of the ocean floor therefore involves much volcanism and diastrophism.

In regard to the origin of the ocean basins, the author disposes of Wegener's hypothesis, and does not favour the suggestion of the foundering of continents. However, he does not view with disfavour the fantastic surmise that they are the scars left by the departure of the moon.

The formation of coral reefs and atolls is discussed, and on the whole the author seems to favour Darwin's subsidence hypothesis, and adduces evidence of extensive submergence in the Pacific region.

The numerous flat-topped seamounts (guyots) of the Pacific have a mean depth of about 800 fathoms. Apparently they are not submerged atolls, but volcanic islands truncated by wave action. The author considers that they were bevelled in Pleistocene times, but other workers regard them as pre-coral and therefore Pre-Cambrian in age, and do not explain how they managed to maintain about the same level throughout the diastropic storms of geological history. This alternative view merely puts back in time, and does not avoid, uplift, bevelling by wave action, and subsequent submergence.

Leading authorities differ as to the origin of the canyons. Shepard and Johnson differ from others, and from each other. Daly and Kuenen agree, but differ from the rest. However, it is noteworthy that Shepard, Daly, and Kuenen all invoke the lowering of sea-level by the Pleistocene ice-sheets as the primary conditional cause. The puzzling problem of the origin of the canyons is thus linked with the ice-age, the origin of which is more puzzling still. The author's final sentence is, "Whatever we find, the indications are that something is radically missing from our knowledge of past geological conditions." Other writers, among whom Umbgrove has been prominent in recent years, have expressed the same view in connexion with diastrophic revolutions, climatic changes, basaltic cycles, etc. The problem is one of great difficulty, and therefore it is with reluctance that the reviewer records his conviction, long and firmly held, that the missing factor has been obscured by persistent acceptance of the sterile dogma of the continuous cooling and shrinking of the earth throughout geological time. The more logical and fertile hypothesis of alternate slow heating and rapid cooling would involve alternate expansion and contraction of the lithosphere and therefore lateral expansion and contraction of the ocean basins and, assuming a hydrosphere of approximately constant volume, would result in alternate regressions and transgressions of the ocean.

Applying this hypothesis to the main problem of the book under review, the Cascadian revolution reached its culmination in late Tertiary times, expressed by maximum elevation of the continents, and accompanied by expansion of the ocean basins and consequent regression of the oceans, which exposed the continental shelf and the upper part of the slope, and enabled rivers to flow over the shelf and start on their courses down the slope, while sediment carried down by the rivers and thus canalized into the incipient canyons would excavate the submerged portions. In this connexion it is noteworthy that the upper portions of the canyons are more deeply incised than are the lower portions.

The Cascadian revolution was accompanied and followed by much igneous activity. As Chamberlin and Salisbury state, "One of the greatest of the volcanic periods falls within the Cenogoic era, just preceding the present geological period, and the volcanic activity of the present is perhaps but a declining phase of that time." This activity would cause great and rapid loss of heat from the lithosphere, and this cooling process, aided by the great difference in the levels of the continents and the ocean, and possibly by some interference with oceanic circulation, would usher in the ice-age. Continued loss of heat would eventually lead to contraction of the lithosphere, including the ocean basins, and the whole process would be reversed. The events following culmination of the revolution would occur in quick succession as they depend on rapid loss of heat by igneous action.

According to this hypothesis, the ice-age and the cutting of the canyons would not bear the relationship of conditional cause and effect; on the contrary, they would be the effects of opposite causes, and the cutting of the canyons would have started before the beginning of the ice-age.

The succession of events outlined above would seem to flow easily and naturally from the hypothesis of a still living and breathing earth, instead of one that has been dying from the moment of its birth, and should have experienced a linear death before it was capable of producing a Cascadian revolution.

It will be appreciated that the problems presented and suggested by the book lie within the fruitful but specious realm of hypothesis, the seminal source of some truth and more error. It is therefore fortunate that the accumulation of new data is proceeding rapidly at the present time. And in regard to the stratigraphy and structure of the continental shelves, it is satisfactory to know that by far the most important contributions to our knowledge will be made by geophysicists, geologists, and other technologists working for the petroleum industry. T. D.

Road Making and Administration. P. E. Spielmann and E. J. Elford. London: E. Arnold & Co., 1948. Pp. xv + 461. 40*s*. net.

This book, written by two authorities very well known in the industry, has just been re-issued in the form of a second edition. As the first volume of the Road-makers' Library, it gives consideration to the whole subject in sufficient detail to be generally useful and to form an introduction to the series. The succeeding volumes are highly specialized and have gone more deeply into the various sections of the subject.

The present edition has been brought up to date in the light of the developments which have taken place in the 15 years since the first edition was published, and an appreciable amount of new material has been incorporated.

Sections are devoted to: (1) the road; (2) the roadway; (3) construction; (4) materials; (5) road surfaces; (6) accessories; (7) plant; (8) cleansing, gritting, etc.; (9) public relations; (10) administration and law; (11) scientific; (12) appendices.

Although the first sentence states that "the road includes not only construction above the subsoil, but also the subsoil itself", only three pages are devoted to foundations and subsoils, the book otherwise relating entirely to surfacing materials, plant, and accessories, apart from relatively small sections on "public relations" and "administration and law."

Hot-rolled asphalt—still one of the most popular forms of asphalt for roads—is given inadequate attention in relation to many other subjects, whilst mixtures of the popular "bitumen Macadam" type are discussed in nine lines under the somewhat surprising title of "pre-coated asphalt." It is, incidentally, unfortunate that references still appear to the old I.M.M. sieves and occasionally to the "melting point" of bitumens, although the more correct term of "softening point" is more frequently used.

Other modern developments upon which one would have liked to see more information are mechanical-spreading machines and consolidation by vibration, together with such matters as thin carpet coats and the revision and extension of standard specifications.

The book is well produced, with some excellent illustrations and should, as indicated in the preface, form a useful introduction to the subject. Many readers will, however, feel the need for more detailed information on certain aspects and will wish to turn to other volumes of this series, several of which have already been issued as post-war editions, or are in active preparation for re-issue. D. C. B.

BOOKS RECEIVED.

Transactions of the Institute of Marine Engineers. Vol. 59, 1947–48. London : The Institute, 1949. Pp. 342 + xxxix.

Includes, in a symposium on "The engineering of cargo vessels of high power," papers on "The direct-coupled diesel engine," by C. C. Pounder; "The geared diesel engine," by C. C. Pounder; "Diesel-electric propulsion," by J. C. Belsey and J. G. Robinson; and "The combustion turbine," by J. Calderwood.

Cumulative Index of the Publications of the Society of Exploration Geophysicists. Tulsa, Okla. : The Society, 1948. Pp. 127.

This replaces the index published in 1940, and is complete for the period 1931–47 in relation to the publications of the Society. It comprises author and subject indexes for articles and for patents.

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Oilfield Exploration and Exploitation.

Geology.

737. Oilfield Geology Made Easy. O. Y. Harland. *Petrol. Times*, 28.1.49, **53**, 78.—Oilfield geology problems, especially those of correlation between wells, and of determination of structure, are discussed, with particular reference to the Trinidad field. C. G. W.

738. Shell Starts to Prove Rich Condensate Area. A. Gibbons. *World Oil*, Jan. 1949, **128** (9), 48.—Five miles south of Elk City in Beckham County the Walters well found distillate in 1947. The completion was at 9260–9360 ft in the granite wash after drilling to 13,133 ft. Ideally the condensate production should be 110 brl/1 million cu. ft. Ordinary separation during testing gave 76 brl/1 million cu. ft. The closed-in bottom-hole pressure was 3996 p.s.i. On a ¼-in choke the flow was 3,100,000 cu. ft/day. G. D. H.

739. Subsurface Cross-Sections from Marion County, Texas, to Osage County, Oklahoma. L. H. Lukert. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **33**, 13–152.—Two continuous cross-sections are presented of the northeastern and north-central Oklahoma and south-central Kansas stratigraphy. The combined length of the cross-sections is approximately 175 miles, and well logs from thirty-three wells are used.

The area described is on, or downdip from, the belt outcrop of Lower Permian and Upper and Middle Pennsylvanian rocks, whose strike is slightly east of north and whose regional dip is westwards. The area contains the transition between deposits of the northern Mid-Continent basin and deposits of southern Oklahoma. Strata penetrated in the wells used in the cross-sections are Palæozoic in age and may be classified in the Permian, Pennsylvanian, Mississippian, Silurian, Devonian, and Ordovician systems. The geologic section studied extends downward from the Herington limestone, which is the uppermost member of the Permian Wolfcampian series. E. N. T.

740. Palæozoic Stratigraphy along Alaska Highway in Northeastern British Columbia. L. R. Laudon and B. J. Chronic. *Bull. Amer. Assoc. Petrol. Geol.*, 1948, **33**, 189–222.—The authors have examined and described in detail the exposures of Palæozoic rocks along the Alaska Highway between Summit Lake (mile 392) and the Liard River (mile 497) in British Columbia. Silurian, Devonian, and Mississippian beds have been studied in detail in this area.

Marine limestones and black shales make up most of the geologic column, although local sandstones are developed. Several hundred irregular but cyclic sedimentary alternations occurred in this area during the palæozoic era. The area is divided into three physiographic provinces which are described. E. N. T.

741. Step-outs Indicate Redwater Strike Will equal Leduc. Anon. *World Oil*, Jan. 1949, **128** (9), 218.—The second Redwater well, 5 miles northeast of the discovery, missed the reef, but wells 5 miles to the northwest and 5 miles to the southeast of the discovery have found oil in the Devonian. Redwater 1 found the Leduc D3 zone at 3110 ft, and gave 1700 b.d. on open flow after acidization.

Northeast of Leduc, Lower Cretaceous sands are giving 39-gravity crude from depths of 4100–4200 ft. G. D. H.

742. Two more Discoveries for Canada's Alberta Province. Anon. *World Oil*, Jan. 1949, **128** (9), 218.—Craigmyle 1 has flowed oil in a drillstem test of the Madison at 4050 ft. The gas flow is estimated at 350,000 cu. ft/day. The oil was 34-gravity. Hanna Pete 3, 16 miles to the southwest, has recovered 24–25-gravity crude from the Sunburst sand at 3716 ft. Previously two wells had found gas distillate in this area, which is about 90 miles northeast of Calgary. G. D. H.

743. Gaspe Ventures has Showings in Eastern Canada Wildcat. Anon. *World Oil*, Jan. 1949, **128** (9), 218.—Showings of gas and oil have been found in Ventura 3 at 2297–2315 ft. A test is to be made. G. D. H.

744. Salina-Guelph Fields of South-Western Ontario. W. A. Roliff. *Bull. Amer. Assoc. Petrol. Geol.*, 1948, **33**, 153–188.—The Lower Salina dolomites and the upper part of the Guelph–Lockport formations of the Silurian form the most important and prolific gas-productive zone in southwestern Ontario, the total gas production to date amounting to more than 275 thousand million cu. ft. This zone has also yielded 1,500,000 brl of oil. Commercial production began in 1889, and by 1906 the two most important gas fields had been discovered. Although eight moderate-sized pools and several smaller pools have been discovered since then, some 80% of the area underlain by these formations remains untested.

The paper describes the geological conditions affecting accumulation and briefly discusses the prospects for future discoveries. E. N. T.

745. Tertiary Formation of Panama Canal Zone and Adjoining Parts of Panama. W. P. Woodring and T. F. Thompson. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **33**, 223–247.—The Tertiary formations of the Canal Zone area of Panama range from Late Eocene to Late Miocene or Early Pliocene. The authors describe and define a number of new formation and member names. E. N. T.

746. Uranium in Petroleum. Longobardi, Florentino, and Mercader. *Argentine Chem. Ass.*, 1947, **35**, 131–136.—The authors claim to have discovered uranium in the ashes of a sample of crude oil from San Rafael, Argentina. The existence of uranium, first detected by radioactivity, was confirmed by chemical analysis and spectrographical methods. The authors point out that the discovery of uranium is closely related to that of vanadium.

747. Wildcat best Producing Well in Southern France. Anon. *World Oil*, Jan. 1949, **128** (9), 220.—A well at Lalongue, near Lembeye, is producing at the rate of 250 b.d.

Near the Rhone a wildcat has reported heavy oil in the Oligocene at about 2400 ft. Oil has also been found in deeper fractured limestones. G. D. H.

748. Po Valley Gas Vital to Italy's Fuel Economy. G. O. Ives. *World Oil*, Jan. 1949, **128** (9), 200.—Italian geologists have estimated the probable gas areas at 12–18 million acres of which less than half a million acres has been developed. The yearly gas output is about 3500 million cu. ft. Pipelines are not yet adequate to meet the needs of the area in which gas has been developed. Reserves of over 6,000,000 million cu. ft. are estimated to exist in an area of some 6 million acres in the Ca' Capello and Consandolo areas of the Po delta region. Production is obtained from several Tertiary formations, and amounts to 2000 million cu. ft/year. The Lodi area embraces 2,500,000 acres, and has reserves of 10,000,000 million cu. ft. It gives 1500 million cu. ft/year from wells averaging 1350 ft in depth. The Pietramala group of fields yields about 400 million cu. ft/year. Some of the gas-bearing structures give small amounts of oil, the aggregate being about 225 b.d. G. D. H.

Geophysics and Geochemical Prospecting.

749. Interpretation of Data from Electrical Resistivity Geophysical Surveys. W. G. G. Cooper. *Nature*, 1948, **162**, 970.—In making electrical resistivity surveys (See Abstract No. 1000 [1948]) two changes are considered: (1) the ratio ρ/ρ_1 is used instead of $\log \rho/\rho_1$; (2) the distance between the electrodes is fixed, and that between the field stations is varied, since this arrangement makes for easier field work.

[Reply by J. M. Hough.] In reply to the points raised above: (1) the number of standard curves is reduced to a single set when logarithmic curves are used; (2) the method of a fixed electrode distance requires a smaller operating team, but in some circumstances the p.d. may be small, and the method therefore insensitive.

H. C. E.

750. The Poulter Method of Geophysical Seismic Exploration. J. E. Kastrop. *World Oil*, Jan. 1949, **128** (9), 53.—Drilling shot-holes is estimated to represent one-third to one-half of the total cost of a seismic survey. Previously shots have been suspended where the rock was too hard or too soft to drill reasonably. Experiments with dry sand show that if the energy intensity is high 5% or less may be transmitted, whereas when the intensity is low it may be 95%. The larger the particles the less the absorption. With buried shots there is much absorption because of the high intensity. For shots suspended a few feet above the ground the energy per unit area may be small, but the total force quite large. Seven to thirteen charges arranged symmetrically have been employed, and with a thirteen pattern it is estimated that every pound of explosive gives a million pounds striking force with a flat wave front. Shaped charges are employed, and with thick, weathered layers the total charge must be high. The spacing of the charges is dependent on the nature of the surface rocks. Simultaneous detonation is essential. Both slow and high-velocity explosives seem equally satisfactory. Standard seismic equipment is employed.

Good results have been obtained on the Edwards Plateau region. G. D. H.

Drilling.

751. Drilling with Industrial Diamonds. K. J. Klapka. *World Oil*, Oct. 1948, **128** (6), 98.—The history of the use of diamonds in drilling is outlined. Modern methods of diamond-core drilling rival the rock-bit method. Their particular application is in drilling very hard formations. The methods and equipment used in the mining industry have been much modified for oil-well drilling. With improved methods and equipment, the salvage value of the bit compensates in part for the initial high cost. Applications of diamond drilling and the methods used are described. C. G. W.

752. Causes and Prevention of Drill Pipe and Tool Joint Troubles. 1. H. G. Texter and R. S. Grant. *World Oil*, Oct. 1948, **128** (6), 79.—Failures due to true twist-offs, spiral tears, and tension have been practically eliminated by improved manufacture and operation. Failure of the last engaged thread has also been eliminated by various methods. Major present cause of trouble is fatigue. Such failures may be corrosion or pure fatigue, and the best method of prevention of failure is the use of adequate drill-collar weight. C. G. W.

753. Large Offshore Drilling Structures. L. S. McCaslin, Jr. *Oil Gas J.*, 3.2.49, **47** (40), 80.—Two of the largest offshore drilling structures yet built are in the process of fabrication for Superior Oil Co. The structures are 100% salvable, and details are described. C. G. W.

754. Relation of Nozzle Fluid Velocity to Rate of Penetration with Drag Type Rotary Bits. 2. J. P. Nolley, G. E. Cannon, and D. Ragland. *World Oil*, Oct. 1948, **128** (6), 87.—Drilling tests, carried out at normally used rotary speeds, are summarized. Tests are at present being performed to determine the influence of rotary speed and of the number of blades on rate of penetration. Conclusions reached are: (1) drilling rate is directly proportional to nozzle fluid velocity; (2) drilling rate is directly proportional to circulating rate; (3) maximum drilling rate is reached when bit weight just short of balling up is applied to the bit, at lower bit weights drilling rate is proportional to bit weight at constant rotary speed; (4) maximum drilling rate is obtained when the product rate of circulation multiplied by bit-nozzle fluid velocity is a maximum. This is subject to the condition that rate of circulation is greater than the minimum for safe return annular velocity.

Data are presented in chart form, and the value will be greater when generalized equations are deduced. C. G. W.

755. Pneumatic Controls for Well-Service Units. R. F. Carlson. *Oil Gas J.*, 3.2.49, **47** (40), 82.—A well-service unit embodying remote air-operated controls is described. Savings in time of as much as 35% are claimed. C. G. W.

756. Wire Lines for Rotary Drilling. E. L. Klingler. *Petrol. Engr*, Jan. 1949, **21** (1), B-24.—Rotary-line service is best evaluated by the A.P.I. ton-mile method. This method does not take into account safety factors, relation of rope to drum and sheave diameters, condition of sheave grooves, excessive loading, line speed, type and grade of line, and practices in cutting off and moving the line to distribute wear. These factors can only be eliminated by the operator standardizing procedures and making frequent inspections. The A.P.I. ton-mile chart is reproduced, and instructions for its use given.

Fast-line loads, hook loads, and dead-line loads for various safety factors are evaluated and tabulated. An example of a calculation of safety factor for specified conditions illustrates their use. A procedure to be followed in cutting off rotary lines is recommended and illustrated by means of example.

General recommendations for use of rotary wire lines are given. C. G. W.

Production.

757. New Oilfield Laboratory. R. Sneddon. *Petrol. Engr*, Jan. 1949, **21** (1), B-7.—Californian Research Corporation's new laboratory for studying oilfield problems is described. C. G. W.

758. Errors in Sub-surface Pressure Gauge Calibration and Usage. R. V. Smith and E. J. Dewees. *Oil Gas J.*, 9.12.48, **47** (32), 85.—Attempts to calibrate an Amerada-type sub-surface pressure gauge to a high degree of accuracy led to an investigation of errors in pressure-gauge uses. Errors are classified as: (1) Inherent errors (inability to reproduce pressure-gauge measurements—changes in gauge characteristics with time). (2) Avoidable errors: (*a*) use of unsuitable charts and stylus; (*b*) pressure shocks; (*c*) failure to reach temp equilibrium; (*d*) failure to reach mechanical equilibrium; (*e*) neglect of air or barometric pressure; (*f*) change of zero-pressure correction with temp.

Calibration was effected by comparison with a piston gauge, the Amerade gauge being immersed in a constant-temp bath. Shocks or pulses were damped by an air chamber between the pump and the gauge. Deflections from a zero-pressure line were measured for various pressures at several calibration temp. Deflections were estimated to 0·001 in using a comparator microscope. Deflections and corresponding pressures at each calibration temp were fitted by the method of least squares to the linear equation

$$P = mD + a$$

where
P = pressure p.s.i. gauge
m = gauge modulus, p.s.i., pressure corresponding to 1-in deflection
D = Deflection from zero-pressure line, in
a = zero-pressure correction, p.s.i.

The errors and their magnitude are discussed individually. It is recommended that the gauge modulus and change of zero-pressure correction with calibration temperature be made the basis of pressure determinations. This necessitates a determination of a zero-pressure correction each time the gauge is used, and this is best done while the gauge is in the lubricator at the well-head. For best results temp gauges should be used in conjunction with pressure gauges. C. G. W.

759. High Pressure Well Equipment Corrosion. W. F. Rogers. *World Oil*, Oct. 1948, **128** (6), 154.—Characteristics of a condensate well of interest from the point of view of corrosion are: (1) pressure of organic acids from 50 to 1500 p.p.m.; (2) acid well-head waters. pH values at well head from 4·0 to 6·0; (3) appreciable CO_2 pressures—from 0·20 to 4·50 mol %, and from 10 to 50 p.s.i. pressure in well gas; (4) low salinity of produced water—total solids range up to 2000 p.p.m.; (5) production of small

amounts of dissolved water; (6) aqueous fluid contains up to 400 p.p.m. of iron from corrosion.

The history of the problem is reviewed. Corrosion rate is known to depend on acidity, salinity, and temperature of the aqueous fluid, and to the fact that metal surfaces are preferentially wetted by the aqueous fluid and not the hydrocarbon. The relative importance of these factors has not been determined. It has been shown that gas velocity affects the corrosion rate, and published data shows that corrosion rate is a direct function of the producing rate. The severity of corrosion attack may be found by determining the iron content of produced water, well-head coupon tests, tubing caliper surveys, and visual inspection. Costs involved in corrosion are determined by a survey of cost analyses by several companies. Protection may be by: (1) protective coatings; (2) corrosion-resistant metals; and (3) chemical treatment. These three methods are discussed.

It is concluded: (1) no corrosive condensate well should be completed as a dual producer, as chemical treatment is rendered more difficult; (2) all condensate wells should have corrosion-resistant master valve; (3) corrosion-resistant tubing should be used; (4) down-the-hole chemical treatment is better done with a packer and perforated nipple rather than open-ended tubing. C. G. W.

760. Methods Used to Estimate Natural Gas Reserves. H. J. Gruy and J. A. Crichton. *Petrol. Engr*, Oct. 1948, **20** (1), 208.—Estimates of reserves are valuable for many reasons, among which are: (1) to determine whether a field justifies exploitation; (2) to design pipelines, etc., to serve the field; (3) to determine location of industries. Gas reserves are defined in three categories: (1) non-associated gas—gas not in contact with crude oil; (2) associated gas—free gas in contact with crude oil; (3) dissolved gas—gas in solution with crude oil.

Non-associated gas may be estimated by two methods: (1) Volumetric method. Sand volumes are estimated by planimetering. Estimates of porosity, connate water, net productive thickness, together with compressibility data on the gas permit calculation of the volume of gas-filled pore space, and available gas. (2) Pressure-decline-curve method. Particularly useful in cases where water drive is not present. Cumulative production is plotted against reservoir pressure and extrapolated to abandonment pressure. The method is made more accurate by several refinements.

Associated gas is difficult to estimate, and it is simpler not to distinguish between associated and dissolved gas but to estimate total reserves.

Dissolved gas is estimated by determining the original stock-tank oil in place and multiplying by the original solution oil–gas ratio. The recovery factor will depend on the mechanics under which production will occur.

Common errors in estimating reserves are: (1) application of pressure curve for an early well to later wells; (2) construction of pressure-decline curves from arithmetic average pressures when well-spacing is not uniform and the number of wells not constant; (3) construction of pressure-decline curves using pressures obtained from isoteric maps which do not cover the same area; (4) failure to check pressure-decline curves by volumetric calculations; (5) failure to consider deviation from Boyle's Law; (6) assuming that neglect of temp and compressibility corrections are compensating. C. G. W.

761. Gas Storage in Water Sand Reservoirs. Anon. *World Oil*, Oct. 1948, **128** (6), 162.—Gas from a natural gasoline plant has been injected into a water sand for storage. About 21,000 million cu. ft. of gas has been injected at a pressure of 3000 p.s.i. The capacity of the reservoir is limited by the limit of closure. The gas–water interface must be maintained above this level. The injection programme is described. Three acid treatments were necessary because of the high injection pressures, believed to be due to lub. oil passing with the gas into the well. After installation of scrubbers no excessive rise in injection pressure occurred. C. G. W.

762. A Study of Gun Perforating [3]. V. L. Forsyth. *World Oil*, Oct. 1948, **128** (6), 142.—Experimental procedure has been described in the earlier papers. This paper discusses the penetrations obtained with gun perforators. The ogival-shaped bullet is now most widely used, since this type reduces the tendency to "tumble" ricochet,

and reduces bullet breakage. The phenomenon of bullet bounceback from the well is mentioned. The marking and striations on recovered bullets may indicate whether or not the formation has been penetrated and the type of formation penetrated.
C. G. W.

763. Chemical Removal of Aluminium Pipe Sections. C. E. Clason. *World Oil*, Oct. 1948, **128** (6), 132.—The practice of using aluminium pipe sections in the oil string opposite oil shows is increasing. Such sections may be removed chemically. The well must be plugged back with gypsum cement to the section and then the section treated. The chemical used is a solution of caustic soda and sodium nitrate. The heat generated by the reaction breaks up cement behind the pipe. Products of the reaction are ammonia gas and a soluble aluminium compound. The treatment may be by dump bailing. This takes from three to five batches, and the product is bailed from the well between batches. In cases where the batch size required is too large for the bailer method, tubing circulation can be used. Time of reaction depends on the well pressure and temp conditions, and a chart is given relating conditions to required contact time. The method may be used to remove packers, retainers, or stuck tools of aluminium. A considerable advantage of the method is that steel pipe is not attacked.
C. G. W.

764. Research in Oil Production. E. G. Gaylord. *Petrol. Engr*, Jan. 1949, **21** (1), B-54.—The importance of fundamental and applied research is emphasized. Major problems at present are to : (1) find new reserves by developing better exploration and exploitation equipment and methods ; (2) develop more efficient production methods ; (3) develop synthetic liquid fuels ; (4) develop economic methods for oil-shale mining.
C. G. W.

765. Laboratory Studies of the Gravitational Drainage of Oil from Unconsolidated Sands. R. V. Higgins and G. B. Shea. *U.S. Bur. Mines Rept. Invest.* 4391, Jan. 1949, 15 pp.—In the laboratory oilfield a low A.P.I. gravity oil was permitted to drain to wells in order to obtain a residual oil saturation in the reservoir of a large depleted oilfield. The sand, thus depleted of its primary production of oil, was used to measure increase in oil yield produced by air drive and by heating to increase oil viscosity.

Air drive produced no oil, probably due to low liquid saturation of the sand interstices. The sand was then heated through a tunnel along the bottom, but little oil flowed to the tunnel. Failure of heat to increase oil recovery was probably due to : (*a*) low oil saturation of the sand, (*b*) low average temp increase throughout the sand, and (*c*) caking of sand near the tunnel.
G. S.

766. Two of World's Largest Separation Stations Installed in Gulf Coast Fields. L. S. McCaslin, Jr. *Oil Gas J.*, 10.2.49, **47** (41), 66.—Operators in Old Ocean field of Brazonia and Matagonda counties, Texas Gulf Coast, have installed two of the largest separation stations in the world, handling daily 17,500 brl of oil and distillate, and 350 million cu. ft. of gas from 150 wells. Total programme includes revisions and additions to flow-line gathering system and absorption plant, and installation of crude-oil and distillate-stabilization facilities. The stabilization facilities are expected to recover 195,000 brl per year of products previously lost to the atmosphere.

The larger station serves a total of ninety-five wells, the smaller fifty-five, and two pressure systems—1750 and 1250 p.s.i.—have been installed to handle production of the seventy-seven gas-distillate wells.

Testing procedures and methods of determing production of each well are described, as are safety features, control equipment, and cutting down loss due to evaporation. The article includes a flow diagram and one literature reference.
W. M. H.

767. Cost Study of a Water-Flood Development. J. K. Barton and R. G. Prentice. *World Oil*, Oct. 1948, **128** (6), 134.—This is a study carried out at Bradford, Penn., of the economic development of a property. Cost figures are the actual figures for December 1947. The figures indicate that a minimum number of five-spot patterns must be completed to ensure a profit and that earlier stoppage of development would result in a net loss on the operation.
C G. W.

Oilfield Development.

768. Interesting Turner Valley Water-flood Experiment. Anon. *World Oil*, Jan. 1949, **128** (9), 197.—The Turner Valley field is 25 miles long and ½–3 miles wide. There are 394 wells of which ninety-one have gas–oil ratios exceeding 30,000. The gas-cap area is about 8100 acres and the oil area 17,000 acres. The original oil content is estimated to have been 750–1000 million brl, and cumulative output to date is some 80 million brl. Primary recovery is expected to give 110 million brl. Production comes from the Madison at depths of 4000–9000 ft. Cuttings indicate porosities of 8–10%. Permeability varies, and the limestone is disturbed by faulting at the north and south ends of the field. Water injection is to be tried in the central part. A water well has been drilled and can give 6000 b.d. Injection of 2000 b.d. at 1100 p.s.i. began in August. About 122,000 brl of water had been injected by mid-October, and some indication of the effects is expected when 600,000 brl has been injected. It is planned to heat the water, thereby reducing its viscosity. G. D. H.

769. Search for Oil and Production of Natural Gas in Southern France. A. Coulaty. *Bull. Ass. franç. Tech. Pétrole*, 1949, (73), 2–24.—The history of oil shows in southern France is briefly recalled, and an account of exploring operations prior to 1937 is given. At present three organizations are searching for oil and gas in this area. Between them they operate twenty deep-drilling rigs and employ over 2000 persons. About 350,000 ft have been drilled, the deepest test well going below 12,000 ft. The financial position of the companies is mentioned. Whilst oil production is small, considerable success has attended natural-gas development, the pipeline distributing system of which has a length of over 300 miles. Production is shortly scheduled to reach 1 million m^3/day, together with 40,000 tons/year of casing-head gasoline and liquefied petroleum gases. Considerable use is made of compressed natural gas as an automobile fuel, amounting to the equivalent of 1 million gal gasoline/month. The article is illustrated with maps and photographs. V. B.

770. Tabulated Summary of Oil Searches in France and the French Union. Anon. *Rev. Inst. franç. Pétrole*, 1948, **3**, 348–351.—Numbers and footage of production and test wells drilled in the first half of 1948 and forecasts for the second half of 1948 and for 1949 are given. V. B.

771. Big Increase in Middle East Production. Anon. *World Oil*, Jan. 1949, **128** (9), 215.—In October 1948 Saudi Arabia produced 468,727 b.d., mainly from Abqaiq. Iran averaged 561,074 b.d. in October, and Egypt 35,440 b.d.

A table gives the production of various countries in September, October, or November, 1948. G. D. H.

Transport and Storage.

772. Corrosion Inhibition with Chromate. 4. Corrosion Problems in Pipeline Systems, Tankers, Petroleum Distribution Equipment. M. Darrin. *Oil Gas J.*, 10.2.49, **47** (41), 82.—Corrosion-resistant coatings and cathodic protection are proving useful for external attack, but are not applicable for internal protection, where chromate and bichromate are giving outstanding results.

Special problems are discussed in connexion with pipelines, gasoline pipelines, pump stations, storage tanks, tank ships, marine diesels, tank trucks, locomotive diesels, and motor-fuel tanks. There are notes on addition of soluble chromate to cutting oils and slushing compounds.

A table gives a summary of directions for the use of chromate in many typical applications, including cooling towers, air-conditioning, several types of diesel, boilers, wells and pipelines, metal treatments, condensers, mercury-arc rectifiers, and car tracks and radiators. There are two literature references. W. M. H.

773. Corrosion of Turbine Journals. S. E. Bowrey. *Mechanical World*, 18.2.49, **125**, 3240, 174 (Institute of Marine Engineers Meeting 8.2.49).—Experience of the Naval

Scientific Service has shown that corrosion-inhibited turbine oils effective in ordinary circumstances are not reliable where seawater is concerned. Retention of salt by minute pits in the steel of journals, gears, etc., causes corrosion which is difficult to arrest. The use of a sodium-nitrite solution circulated with the oil until the seawater has been eliminated from the system has been applied successfully and any existing corrosion arrested.

Trials were carried out at sea in the main engine of a destroyer. Sodium nitrite gave satisfactory protection in the presence of a large amount of added seawater, and corrosion in progress stopped. The application of the method to a ship where rusting of gears and journals was active obviated the need for refit and prevented further trouble during six months of subsequent service. Similarly, the treatment was applied to the engines of a ship of the Fleet during the last autumn cruise because of a discovery of seawater in the oil system. No corrosion or damage was in evidence at the end of the cruise. H. S.

774. Automatic Controls of Natural Gas Lines. W. A. Brewster. *World Oil*, Oct. 1948, **128** (6), 179.—Controls and accessories for gas pipeline use include : (1) indicating pressure controllers ; (2) recording pressure controllers ; (3) differential controllers ; (4) differential limit controllers ; (5) pressure limit controllers ; (6) remote controls ; (7) pressure boosters ; (8) plot-loaded regulators.

These types of controls are described, and their installation and operation discussed. C. G. W.

775. Natural Gas Goes North. B. D. Goodrich. *Chem. Engng*, 1948, **55** (6), 106.—An account is given of the conversion of a 1500-mile pipeline (Texas to the Atlantic coast) from wartime duties of petroleum transport to peacetime gas-transmission lines. Use has been made of centrifugal compressors for effecting transport, running at 3600 r.p.m. Reciprocating compressors were also included at some pump stations on route to enable metering control to be obtained. R. T. W. H.

776. Cost-imating—Clay and Cement Pipe. W. L. Nelson. *Oil Gas J.*, 3.3.49, **47** (44), 61.—Five tables are given in No. 20 of this series. Tables 1, 2, and 3 show the 1946 material costs of clay-tile, concrete, and cement-lined pipe (lining only) for various sizes of pipe. Table 4 gives the relative costs of excavation and shovelling different types of soil. The fifth table shows the variation in cost of brick and tile material, cement material, and refinery labour from 1926 to 1948. A. S.

777. Effect of the Depth of Burial of Steel Pipes on the Thermal Stresses. S. N. Aronov. *Neft. Khoz.*, 1948, (12), 51–53.—From determinations made at five places in various climatic regions of the U.S.S.R., both in summer and winter, it is shown that the depth of pipe burial need not exceed about 1·5 m in order to decrease stresses caused by thermal expansion to the practical min. Such stresses caused by climatic conditions do not exceed about 100 kg/cm², as compared with stresses of up to 1000 kg/cm² occurring during the welding of the pipe and operation of the line. V. B.

778. High Speed Pump Operation. F. V. Cook. *World Oil*, Oct. 1948, **128** (6), 187.—Experience with high-speed reciprocating pumps—up to 400 r.p.m.—are described. The major difficulty has been slow valve operation, with consequent shock loads resulting in cylinder and piping failures. As well as light low-lift valves with a wide area and heavy springs, pressurized suction is considered necessary to efficient operation. C. G. W.

779. Insulation of Tanks—Four Case Studies. J. C. Moore. *Chem. Engng*, 1948, **55** (6), 110.—The insulation of four different types of storage tanks, using mineral-wool blocks, protected by an outer weather-proofing layer of fibrated emulsified asphalt, is described. This method has been successfully applied to vertical and horizontal cylindrical tanks, steam-boilers, and spherical tanks. A very high insulation efficiency is claimed. R. T. W. H.

Refinery Operations.

Refineries and Auxiliary Refinery Plant

780. Low Pressure Burners. I. Basic Principles of Oil and Air Delivery in Various Types. F. Feigenbaum and J. E. Dignam. *Fuel Oil & Oil Heat*, Nov. 1948, 7 (7), 55.—The low-pressure burner incorporates the air-friction nozzle for breaking up the oil, and it is almost impervious to the changes in viscosity of present-day fuels. All low-pressure burners apply the air-friction principle to the division of the fuel into particles. A development in nozzles was the closed nozzle in which air and oil met inside or before a hollow shell, the air stream breaking the oil across a common orifice. Fault arising was due to tendency of elements to interfere with each other, pulsating flame resulting. To remedy this the single and parallel delivery was developed. A single-delivery type of burner, the Winkler, is a burner of conventional external design. A motor drives the pumping units directly, across the fan housing. Oil- and air-pumps are contained in a single unit. Fuel pump is strictly a metering device. A diagram is included.

Most low-pressure burners are of the sump-separation type. All cycle burners apply the basic cycle of operation. In this, parallel delivery is obtained by: (1) mixing air and oil while bringing them through the pumping process; (2) separating them in the sump or separating chamber; and (3) remixing in the nozzle. The parts used in cycle-type burners are a rotary compressor, a sump, and a nozzle. Brief descriptions and diagrams are given. D. K.

781. Calculation of Practical Dephlegmator Performance. A. Smola. *Chim. et Ind.*, 1949, **61**, 134–143 (Translated from *Mitt. Chem. Forschungsinst. Ind. Oesterr.*, 1948, **2**, 73–82).—Following a brief discussion of the theory of dist and of the part played by reflux, the three limiting conditions which can occur on a dephlegmator (reflux condenser) are considered, *i.e.*, min enrichment in the volatile product, max enrichment, and phase equilibrium condensation. A graphical method for calculating dephlegmator performance is described; this is based on examination of samples of the final product and of liquid from the top and bottom of the column, using principles developed by McCabe and Thiele (*Industr. Engng Chem.*, 1925, **17**, 605) for the graphical calculation of fractionating columns. The cases of two simple mixtures (methyl alcohol-water and acetic acid–water) distilled in a nine-tray experimental column having a tubular reflux condenser at the top are considered in detail as examples. V. B.

782. Cleaning Tubular Heat Exchangers. P. F. Dougherty and C. H. Brooks. *Petrol. Engr*, Jan. 1948, **21** (1), C-33.—The various methods of cleaning tubular heat exchangers are discussed. For "in-place" cleaning these include: (1) solution of the fouling in chemical reagent; (2) suspension of the fouling in the cleaning fluid; (3) solution of fouling in organic solvent.

The mechanical methods discussed include lancing, drilling, and rodding and sand blasting. The advantages and disadvantages of "in place" and mechanical methods are also discussed. G. K. A.

783. Discussion of Methods of Cleaning Heat Exchangers. J. S. Connors and L. J. Weber. *Oil Gas J.*, 3.3.49, **47** (44), 61.—Scale on water side of heat-transfer equipment in natural gasoline industry is great problem. Loose deposits generally most detrimental to heat transfer. Calcium and magnesium carbonates removed by solutions of inhibited hydrochloric acid. Closed coolers cleaned by circulating acid solution, raising temperatures as acid strength declines. "Coil in box" equipment cleaned by spraying coils, which are washed periodically with high-pressure water to remove insoluble sludge so acid solution can reach soluble scale underneath. Atmospheric cooling-tower sections cleaned by surrounding coils in tank during spraying or immersion. When silica present in scale, intensifiers (hydrofluoric acid) added to acid. Calcium and magnesium carbonates cemented by their sulphates removed by two-stage cleaning. 5–7% sodium carbonate at 212° F dissolves sulphate cementing bond. Equipment then acid washed. Tubes cleaned internally by water or steam lance. For hard scale drill fitted to lance. External cleaning by rapping tubes and wire

brushing. Thermal shock treatment is cheap method of removing some scales. Some organic scales partially oxidized then washed out with high-pressure water. Highly combustible scale must be burned out carefully to avoid damage to tubes. Burning furnaces produce atmosphere for oxidation of polymers or combustible fouling. Bundles housed in furnace and atmosphere controlled 10–15% excess air. A. S.

784. Numerical Evaluation of Equations Describing Transient Heat and Mass Transfer in Packed Solids. A. Klinkenberg. *Industr. Engng Chem.*, 1948, **40**, 1992–1994.—An approximation of the exact solution of equations describing transient heat and mass-transfer phenomena in packed solids is worked out by the introduction of error functions. A nomograph, sufficiently accurate for all practical purposes, is given. R. G. T.

785. Sulphuric Acid vs. Materials of Construction. II. Anon. *Chem. Engng*, 1948, **55** (6), 223.—Part II is a symposium on materials suitable for sulphuric-acid service.

1. *Precious metals.* The resistance of silver, palladium, gold, platinum, and its alloys is given, under varying conditions.

2. *Durimet.* Durimet 20—a highly alloyed austenitic stainless steel—is highly resistant, especially at high temperatures and concentrations.

3. *Carbon, graphite*, and Karbate materials are shown to have many uses under widely varying conditions. (See Abstract 1650 [1945].) R. T. W. H.

786. TXL Plant Conserves 50,000,000 ft of Gas. A. L. Foster. *Petrol. Engr*, Jan. 1949, 21, **1**, C-7.—Photographs and flow sheets are given of a natural-gas-treating plant handling 50 million cu. ft. per day. Details are given of the main scrubbers, the gasoline-treating unit, water-treatment plant, and gas purification. G. K. A.

Absorption and Adsorption.

787. Hunt Oil Co Completes Two New Gasoline Plants in Ark-La-Tex Area. D. H. Stormont. *Oil Gas J.*, 24.2.49, **47** (43), 124.—The larger plant, situated in Lisbon field, northern Louisiana, handles 50,000 million cu. ft. of gas daily, second plant is at Harleton, Texas, and processes 30,000 million cu. ft. daily. Both plants designed and constructed by Delta Engineering Corporation, the Lisbon plant only described.

Conventional high-pressure absorption system used except for a rich-oil contactor built integrally into the lower half of the re-absorber. The operation is completely stable. Products are fractionated in usual equipment.

Tables give analysis of Lisbon field wet gas and typical day's output of products. A flow sheet is provided. G. A. C.

788. Dynamic Cooling of Adsorbent Beds. E. Ledoux. *Industr. Engng Chem.*, 1948, **40**, 1970–1977.—Since adsorption eff falls off at high temp, adsorbent beds must be cooled before each run. Accurate determination of the cooling cycle is essential to eff design.

The theoretical basis for the cooling curves of a bed of any broken solids is discussed, and a graphical method for their determination is presented. The procedure is based on heat-transfer equations whose deviations are given. The curves are plotted in dimensionless co-ordinates enabling their use with any consistent system of units for the solution of cooling problems.

Numerical examples are given as illustration of practical application and as comparison of open- and closed-circuit cooling of beds. Use of the curves for experimental determination of H.T.C., sp. ht. of adsorbent, and correlation of experimental data is described. Closed-circuit cooling is discussed with special reference to the application and effect of a counterflow cooler. Modification of the method to allow for heat loss to the surroundings is developed. Variable flow cooling introduces complications; formulæ for the derivation of variable-flow cooling curves are given. R. G. T.

789. More Propane for Less Money. Z. C. Ambrose. *Petrol. Engr*, Dec. 1948, **20** (3), 220.—Following the increase in the demand for propane, absorption plants are being designed for its recovery. From previous experience a new plant is being built having the following features: (1) the wet gas is dehydrated before the absorption process

and so the gas and the absorption oil can be cooled to 60° F without hydrate formation; (2) a low-mol-wt. oil can be used for absorption, the low temp reducing retrograde evaporation; (3) the use of the light oil cuts down the amount of oil circulation required and increases propane recovery. G. K. A.

Cracking.

790. T.C.C. Unit Catalytically Processes Sour Gas Oil. W. M. Carney, H. D. Noll, and A. W. Hoge. *Petrol. Engr*, Nov. 1948, **20** (2), 246.—The charging stock has an average sulphur content of 1·7% by weight. Low-temperature operation with a nominal amount of reflux is used to give a combined yield of 10 lb R.V.P. gasoline and 600° F end point distillate fuel oil of about 70% by volume. The gasoline has a sulphur content of 0·1% by weight after a caustic wash, and it meets all specifications.

Of the sulphur charged to the unit, 55% appears in the gas and coke, 42% in the cycle stock, and 3% appears in the gasoline.

A description of the cracking unit is given together with the precautions taken against corrosion. G. K. A.

791. Fluidized Solids Pilot Plants. E. W. Nicholson, J. E. Moise, and R. L. Hardy. *Industr. Engng Chem.*, 1948, **40**, 2033–2039 (*Symposium on Pilot Plant Design and Construction, Division of Industrial & Engineering Chem., Am. Chem. Soc.*, 113th Meeting, Chicago).—The fluidized-solids technique, mainly applied in the field of cat cracking of petroleum oils, will find increasing application in other processes. It is particularly adapted to processes requiring the addition or removal of heat, especially where isothermal conditions are desirable, and its advantages and possible limitations are first discussed.

Basic steps necessary for the design of a pilot plant utilizing the technique are presented, and a typical apparatus used for small-scale fluidization studies is described. The translation of data obtained in such equipment to the design of large-scale plant is outlined, and specific features, such as solids–gas distribution and solids-recovery equipment, are described. Methods of measurement and control of temp, densities, and solids flow rate are discussed with the relation of heat transfer of temp control. R. G. T.

792. Hydroforming Pilot Unit. L. T. Yule and R. B. Bennett. *Industr. Engng Chem.*, 1948, **40**, 1995–1998.—It has been necessary to establish a correlation between the results obtained in the pilot unit and in the commercial hydroforming plant. The paper describes the equipment employed in a fixed-bed hydroforming pilot unit and explains its operation. Comparison of results obtained from the pilot and commercial plants shows excellent agreement. The effect of operating variables upon product yield and quality is described briefly. R. G. T.

793. Montmorillonite Cracking Catalyst (X-Ray Diffraction). A. Grenall. *Industr. Engng Chem.*, 1948, **40**, 2149–2151.—The presence of Montmorillonite clay in the commercial clay cracking cat Filtrol, over the cat active temp range is demonstrated by X-ray powder diffraction. At about 1560° F this phase is destroyed and cracking activity for gasoline production disappears. Steam heating of the cat has little effect below 1100° F. At 1400° F in 100% steam a decrease in pattern intensity occurs. An explanation of this latter phenomena is advanced, postulating the existence of a relation between X-ray intensities cat activity, and concn of hydrogen ions and/or water adsorbed on the clay. The presence of hydrogen ions was proved, and quantitative investigation into the hydrogen-ion content of heated Filtrol clay cat is to be published subsequently. R. G. T.

Alkylation.

794. Aluminium Chloride Solution in Nitroparaffins (Catalysts for Hydrocarbon Reactions). L. Schmerling. *Industr. Engng Chem.*, 1948, **40**, 2072–2077.—Anhydrous $AlCl_3$ has certain undesirable properties which limit its use as a cat for hydrocarbon conversions. It is often excessively active initially and may cat undersirable side

reactions. Addition compounds with aromatic and olefinic hydrocarbons form a sludge usually causing decreased activity and decreased life of cat. It is therefore frequently advantageous to use a cat which has uniform activity and const physical state. Fluid $AlCl_3$ is therefore the logical choice permitting efficient use as a cat. Unlike the ether, acetone, and alcohol solutions, the solutions of $AlCl_3$ in nitroparaffins (nitromethane, nitroethane, and the two nitropropanes) are cat active, the active component being the addition complex: $AlCl_3.RNO_2$. Moreover, the nitroparaffin solutions are miscible with benzene, and homogeneous-phase alkylation may be accomplished by contacting the clear solution with an olefine or alkyl halide. To permit recycling the cat layer may be salted out by addition of NaCl.

Alkylation of *iso*paraffins with olefins is facilitated by using those solutions which are not soluble in paraffins and are therefore available for recycling. Higher reaction temps are necessary than those used with unmodified $AlCl_3$. Alkylation of *iso*butane with propane is easier with the nitroparaffin solution. When *iso*butane is reacted with *iso*propyl chloride in presence of unmodified $AlCl_3$, the main reaction is the reduction of the chloride to propane. But with the nitromethane solution of $AlCl_3$ reduction of the chloride is markedly decreased, and alkylation of *iso*butane to heptane occurs. The solutions are not effective cats for the *iso*merization of *n*-paraffins and naphthenes (less than 2% isomerization of *n*-heptane and methyl *cyclo*pentane). Experimental detail is given for most of the conversions. R. G. T.

795. Effect of Hydrogen on Action of Aluminium Chloride on Alkanes. V. N. Ipatieff and L. Schmerling. *Industr. Engng Chem.*, 1948, **40**, 2354–2360.—The effect of mol H_2 at superatmospheric pressure on the action of $AlCl_3$ on alkanes is discussed. The alkylation of *n*-pentane by pure $AlCl_3$ at 125° C is suppressed by H_2. If N_2 is present butanes, hexanes, and other high-boiling alkanes are produced, and the cat is converted to a viscous red liquid. If the reaction in H_2 is promoted by HCl or water, isomerization to *iso*pentane occurs in excellent yield with very little side reaction and no destruction of the cat. Hydrogen does not prevent the autodestructive alkylation of heptane and higher alkanes. If, however, HCl is used, destructive hydrogenation occurs. This results in higher yields of *iso*butane and less cat complex. In addition, the cat complex formed during destructive hydrogenation is more active than that formed in the absence of H_2, involving longer cat life. Destructive hydrogenation of a Fischer–Tropsch naphtha is described, and the effect of certain variables is discussed. R. G. T.

Isomerization.

796. Isomerization of *n*-Pentane. (Effect of various additives.) J. M. Mavity, H. Pines, R. C. Wackher, and J. A. Brookes. *Industr. Engng Chem.*, 1948, **40**, 2374–2379.—Considerable cleavage and disproportionation usually accompanies the isomerization of *n*-pentane in the presence of $AlCl_3$–HCl cat. Modification of the reaction by various organic additives is described. Effective repressors of side-reactions include naphthenic and aromatic hydrocarbons, straight-run C_6 fractions with moderate concns of C_6H_6 or C_6 naphthenes, and aromatic derivatives—chlorobenzene and diphenyl ether. Careful control of the concn of a given additive is necessary to obtain the optimum effect—excess is found to repress the main isomerization as well as the side reactions. (Optimum concns were, *e.g.*, 5–10 vol-% *cyclo*hexane, 0·25–0·5% benzene.) Batch and continuous tests of the $AlCl_3$-pick-up type were made. In the latter the additive has the additional function of repressing sludge formation in the $AlCl_3$ supply zone. A discussion of the reaction mechanism completes the paper. R. G. T.

Chemical and Physical Refining.

797. Polar Type Rust Inhibitors (Theory and Properties). H. R. Baker and W. A. Zisman. *Industr. Engng Chem.*, 1948, **40**, 2338–2347).—Various physical and chem phenomena involved in the adsorption of polar solutes from non-polar and weakly polar solutes are discussed. The rust-inhibitive properties of many polar compounds are analysed with reference to properties of the adsorbed mols such as hydrophobicity, energy of adsorption, relation of temp to adsorptivity, steric hindrance to close-packing, penetrability of the monolayer by water mols, and solubility of the

monolayer in water. The rust inhibition exhibited by a reference pet oil by the addition of a variety of polar compounds, mostly pure, has been investigated using the turbine oil-rusting test at various concns and temps. A theory is outlined, to interpret the results which are also classified. Further generalization of the conclusions includes a comparison of the data obtained from polar compounds dissolved in pet oils, pure hydrocarbons, chlorinated hydrocarbons, aliphatic diesters, polyalkylene glycol derivatives, and various types of silicone fluids. Extensive bibliography is included. R. G. T.

798. Colour Contamination of Petroleum Products Transported by Pipeline. L. V. Sorg and R. E. Dicky. *Industr. Engng Chem.*, 1948, **40**, 2163–2166.—In a field trial of an experimental alkaline corrosion inhibitor in a pipeline system handling finished pet products ranging from motor fuels to burning oils, a noticeable and objectionable colour-contamination problem arose. The compound responsible for this discoloration of water-white products was isolated and identified as indophenol. It is formed in the strongly alkaline corrosion-inhibitor phase, from a reaction between an oxidn product of an antioxidant in the fuel, and naturally occurring phenol. These compounds are conc in the inhibitor phase. Concns of 1 part *p*-indophenol in 5 million impart an objectionable pink colour to water-white products such as kerosine. The addition of sodium sulphite to the inhibitor will eliminate the colour without affecting the action of the inhibitor. The action of sodium sulphite is to reduce the dye to the colourless leuco base and to minimize dye formation. R. G. T.

799. The Catalytic Oxidation of Coal and Petroleum Products with Air (Review). J. D. Brooks. *Brit. Coal Util. Res. Assn. Monthly Bull.*, 1948, XII (11), 393.—Intermediates for manufacture of plastics, detergents, textiles, dyes, and fine chemicals can be produced by direct cat oxidation of coal-tar and pet fractions. The most common cats, promoters, and conditions required are discussed.

Aliphatics are important in oxidation to alcohols, acids, esters, formaldehydes and to synthesis gas for the Fischer–Tropsch synthesis. Olefins are used in production of olefin oxides and glycols for solvents and detergents. High-boiling pet fractions are oxidized to long-chain-alcohols, aldehydes, acids, and modified fuels. Liquid-phase oxidation of aliphatics to alcohols, aldehydes, acids, and in production of soaps and edible fats is reviewed.

Aromatic oxidation is important in that phenol so produced is used in the production of thermosetting plastics. The conditions, cats, and mechanism of reaction are briefly discussed. Aldehydes, acids, phthalic anhydride, and acetophenone are amongst the more important products obtained from side-chain aromatics. Naphthalene hydrocarbons and tricyclic aromatics can be oxidised to many other listed products.

The review ends with a description of industrial oxidation apparatus showing the fixed-bed and fluidized-bed methods, and brief mention is made of direct non-cat combustion. The bibliography is extensive. R. G. T.

800. Extraction of Polar Constituents from Hydrocarbon Solutions (Field Application in Natural Gas Condensate Wells). D. A. Shock and N. Hackerman. *Industr. Engng Chem.*, 1948, **40**, 2169–2172.—For removal of corrosive acidic organic constituents of the hydrocarbon phase of gas-condensate wells, alkali extraction is found to be inefficient and expensive. Adsorption was suggested to remove the objectionable solutes. Laboratory-scale adsorption and recovery of compounds typically found in the system under investigation used commercial SiO_2 gel. as the adsorbent. Compounds studied were acetic and naphthenic acids and resorcinol. The method proved feasible on a large scale, and a simple apparatus for field experiments is described. Effective extraction depends on low flow rate and removal of adsorbent at stated intervals. R. G. T.

801. Diolefins in Alkylation Feedstocks (Conversion to Mono-olefins by Selective Hydrogenation). J. Anderson, S. M. McAllister, E. L. Derr, and W. M. Peterson. *Industr. Engng Chem.*, 1948, **40**, 2295–2301.—Processes for the purification of unsuitable refinery fractions were investigated with the object of extending the supply of butylene and amylenes to alleviate the crit wartime shortage of light olefins for alkylate gasoline

manufacture. Materials containing diolefins were available, and a process of selective hydrogenation was devised to convert the diolefins to mono-olefins in the vapour phase. Supported nickel-sulphide cats are used having a high selectivity. They are active for hydrogenation of diolefins to mono-olefins, but not for the conversion of mono-olefins to paraffins, between 200° and 300° C even with excess H_2.

Excellent alkylation results are shown for butene and pentene fractions having objectionably high diolefin contents rendering them unsuitable for non-paraffin alkylation. The hydrogenated materials had mono-olefin contents corresponding to the combined concn of diolefins and mono-olefins originally present, and alkylate yields were correspondingly improved. Continuous vapour-phase operation under conditions obtained in existing hydrogenation units—cat-cracking plants or plants for conversion of butene dimers to *iso*-octanes is described.

The nickel-sulphide cat employed in most of the work was prepared from commercially plentiful nickel carbonate–alumina by action of H_2S at 400° C. Cat life is >1000 hr when heating a C_4 fraction containing 23 mol-% butadiene. Regeneration of cat is by burning and resulphiding. R. G. T.

802. Elemental Sulfur from Petroleum Gases. R. A. Graff. *Oil Gas J.*, 17.2.49, **47** (42), 99.—Several plants for recovering elemental sulphur from gas-bearing hydrogen sulphide stripped from tri-potassium phosphate or ethanolamine-type gas-purification units are projected.

The history of sulphur recovery, which began in England nearly 100 years ago is traced, and improvements in operating procedures outlined. Flow sheets are given. Discussion of materials of construction for sulphur-recovery units shows that all gases handled must be above dew-point to avoid corrosion of cast-iron or carbon-steel plant.

Critical velocities must be maintained around sulphur condenser and separator. G. A. C.

Special Processes.

803. Petroleum Chemical Detergents. M. Sittenfield. *Chem. Engng*, 1948, **55** (6), 120.—Of the various types of detergents derived from petroleum hydrocarbons, the alkyl benzene sulphonates are described in detail.

The general manufacturing process is fully described—including a flowsheet, and the influence of the alkyl chain length on detersive properties is discussed.

The three main operations involved in manufacture consist of: (1) manufacture of the alkyl benzene, from benzene, chlorine, and kerosine; (2) sulphonation; (3) neutralization of the sulphonic acid, and subsequent processing.

Materials of construction and operating details are included in the description of the process.

The possibilities of manufacturing these detergents with a definite, instead of haphazard chain length, by polymerization of the lower olefins, is discussed. Manufacturing costs are also given. R. T. W. H.

804. Recovery of Ethylene from Coke-oven Gas. P. M. Schuftan. *Industr. Chem.*, 1949, **25**, 156–162.—Water vapour, CO_2, H_2S and C_2, and higher hydrocarbons are condensed in the first cooling stage. In the second stage a condensate is formed, rich in ethylene and rectified to give pure products. The process is described in some detail. A flow diagram and references are given. E. B.

805. Fischer–Tropsch Cobalt Catalysts. (Influence of Type of Kieselguhrs.) R. B. Anderson, A. Krieg, B. Seligman, and W. Tarn. *Industr. Engng Chem.*, 1948, **40** (12), 2347–2350.—Testing data are presented for a series of cobalt–thoria–magnesia–kieselguhr cats prepared from commercially available American kieselguhrs. Calcined kieselguhrs produced cats having lower activity than cats made from natural kieselguhrs. Highest activity was obtained with cats made from acid-extracted, natural kieselguhrs. The density of the cat depends on the parent kieselguhr and affects the distribution of the products. The denser cats formed a greater % of light hydrocarbons and CO_2. R. G. T.

806. Problems Associated with Fischer–Tropsh Process. E. Ayers, C. W. Montgomery, and J. H. Hirsch. *Petrol. Engr*, Dec. 1948, **20** (3), 203.—Because 2000 vol of gas are

passed through the reactor to make 1 vol of liquid fuel, the largest part of the cost of the synthesis is on account of the amortization and maintenance of equipment. To get more economic space–time yields the conditions have been made more severe than in the German process, thus aggravating the cat problem.

Present tendency is to seek cheap naturally occurring cats so that the cat life is not controlling. Carbon deterioration of the iron-cat is serious, carbides are formed with high carbon content, and these, together with diffusion of carbon, break the cat pellets into powder, greatly increasing the pressure drop across the bed. Normally high proportions of gaseous hydrocarbons are formed, and the percentage of liquid product cannot be increased without a corresponding increase in wax production. The deposition of the wax is serious as it leads to agglomeration, local overheading, and carbon deposition. The cat mechanism has also still to be worked out before optimum conditions can be obtained.

The consumption of power is considerable, as is the heat lost and the latter presents a problem in the provision of adequate cooling of the cat bed. G. K. A.

807. Production by Pressure Gasification and Synthesis of Methane for Long Distance Transmission. O. Dorscher. *Erdöl u. Kohle*, 1949, **2**, 59—65.—A description with flow-sheet of a process developed by the Lurgi Co. for the simultaneous production of synthesis products (gasoline, light oil, wax) by the Fischer–Tropsch process and of methane. Gasification of coal is carried out at 10–30 atm using O_2 and steam. The final gas contains 84% methane; operation of the scheme is flexible so that both summer and winter conditions can be suited and peak demands for gas readily met. The gas produced is likewise suitable (when compressed) for use as an automotive fuel. The total heat recovery in the process (on gas intake) is 86%; heat balances and analyses of the products are given. The economics of the process and the possibility of expanding the German gas grid on a methane basis are discussed. In contradiction to the findings of Prettre (see Abstract No. 1195 [1947]) participation of methane in the Fischer–Tropsch synthesis reaction could not be detected. V. B.

808. Reaction Mechanism of the Fischer–Tropsch Synthesis. H. Kölbel and F. Engelhardt. *Erdöl u. Kohle*, 1949, **2**, 52–59.—Investigation was made of the reaction $CO + H_2O \rightleftharpoons CO_2 + H_2$ using iron (Fe + Cu + K_2CO_3) and cobalt (Co + Th + Mg) cat. Equilibrium const for the reaction in the temp range 140–300° C was calc, and the cats were used in various physical states. The oxide state of the iron cat is almost inactive, but the "metallic," "industrial," and "carbide" states all showed considerable activity (at 240° C), in that order, which likewise applied to the cobalt cat, although in the latter case divergence between the activity of the three states of the cat was more marked. An analytical method for the examination of the iron cat to distinguish between "metallic" and "carbide" states was developed. The temp coeff of cat activity was similar for both metals, the lower temp limit of activity being about 180° C for the space velocity at which the tests were made, *i.e.*, 100 l/l cat/hr and with a CO–H_2O ratio of 1 : 1. With a decrease in the space velocity to 1/10 of the previous value and a H_2–CO ratio of 2 : 3·6 the CO is almost completely converted to CO_2, using the cobalt cat. Using the iron cat at 200° C (H_2–CO = 2 : 1) with the normal space velocity and with removal of water (by $CaCl_2$) as this is formed a conversion in the water direction of up to 82% of the reacting CO can be obtained. It is considered that CO_2 formation on cobalt and iron cat during the gasoline synthesis is to be ascribed to a secondary reaction with CO of the water that is primarily formed. The theoretical aspects of the work are discussed, and a tentative reaction mechanism suggested. V. B.

809. Recent Research on the Fischer–Tropsch Synthesis. C. C. Hall. *Industr. Chem.*, 1949, **25**, 163–173.—Laboratory experiments with a fixed-bed Fe cat at approx 300° C were successful in converting 95% CO at space velocity up to 1000 vol/vol cat/hr. Recirculation repressed CO_2 formation and increased H_2–CO utilization and CO converted to C_2 and higher hydrocarbons from 60 to 80%. Over half the hydrocarbons were C_3–C_4 with 75% olefin content. Plant processes under similar conditions would fail because of heat-transfer difficulties. Almost complete conversion occurred at 300° C with fluidized Fe cat despite space velocity of 750–1050 vol/hr. Elimination of CO_2 formation, high H_2–CO utilization, and improved C_3–C_4 yield realized were

attributed to high recycle ratio required to maintain fluidization. CO utilization was not much less than in German commercial plants using Co cat and space-time yields of hydrocarbons fifteen times greater. In comparable experiments using Co, highest conversion was 80% at 500 vol/hr, C_1–C_4 hydrocarbons contained 50% olefins.

Experimental details are tabulated and apparatus described. The mechanism of the reaction is discussed, and evidence presented in support of the theory of primary production of alcohols. E. B.

810. Dry Ice from Natural Gas. R. Sneddon. *Petrol. Engr*, Jan. 1949, **1** (21), C-15.—The gas contains 16% CO_2, 34 g per 100 cu. ft. of hydrogen sulphide and 0·86 gal per 1000 cu. ft. of natural gasoline. Originally the raw gas was treated with soda-ash solution and iron oxide to remove H_2S. The low cal. val. made it necessary to remove part of the carbon dioxide, and this is done by ethanolamine–water solution. The carbon dioxide is regenerated by steam strippers, purified by contact with iron-oxide solution to remove hydrogen sulphide, chromate–borax solution for removal of amine vapour, and then permanganate solution. It is solidified by compressing to 1100 p.s.i. and cooling and then flashing in stages to atmospheric pressure. G. K. A.

811. Union Develops Shale Oil Retorting Method. H. Reed and C. Berg. *Petrol. Engr*, Dec. 1948, **20** (3), 214.—After considering the processes used in other parts of the world the Union Oil retort is described. A 2-ton/day pilot plant and a 50 ton/day semi-commercial plant have been built. The kiln is conical in shape, and the shale is fed from underneath into the smaller end and the clinker is removed at the top by a scraper mechanism. A blower draws air in through the top of the kiln and discharges the gas through a liquid separator into the fuel gas overhead. At the top of the kiln the air is preheated by the hot clinker leaving the retort, in the lower part of this zone combustion of the carbon residue on the clinker is effected, the fuel gas from which vaporizes the oil in the shale below. The rich gas then meets the cold-feed shale, preheating the shale and condensing the oil. The oil is then run off at the base. From the pilot plant 58 gal of shale oil per ton of shale was obtained, together with 19,000 cu. ft. of 188 B.Th.U. content gas. G. K. A.

812. Synthetic Rubber Pilot Plant. J. V. Hightower. *Chem. Engng*, 1948, **55** (6), 100.—A detailed account of the Phillips pilot plant and process for the manufacture of low-temp rubbers is given. The reactor can be operated over a range of temp, enabling polymerization to proceed at temps of from 41° down to below 14° F. Details of materials of construction are also included. R. T. W. H.

813. Synthetic Fuels. Anon. *Chem. Engng*, 1948, **55** (6), 131.—A detailed account of the present position in the U.S.A. regarding the production of synthesis gas and synthetic fuels is presented. Widespread investigations are in progress on both small experimental, and semi-commercial scales. The most promising raw material, on an economic basis, is natural gas, which should produce liquid fuels more cheaply than those currently produced from crude oil. Synthetic fuels from coal or from oil shale appear to be somewhat more costly.

A survey of fuel resources is included, together with U.S. Government activities in this connexion. The technical improvements on the original German process, particularly the use of the fluidized-cat technique, are stressed, followed by detailed descriptions of the principal pilot plants now under erection. R. T. W. H.

Metering and Control.

814. Pressure Measurement in the Chemical Industry. J. R. Fawcett. *Industr. Chem.*, 1949, **25**, 149—155.—Gauges used in the chemical industry are described and illustrated with diagrams. The choice of materials used in their construction is discussed with reference to the chemicals encountered in operation. E. B.

815. Recording Mechanical Pressure Gauge of High Range. P. M. Higgs. *Rev. sci. Instrum.*, 1949, **20**, 23–26.—An instrument of rugged construction for recording very large and rapidly fluctuating pressures in liquids and gases is described. The pressure-

sensitive element is a thick, flat, circular diaphragm, rigidly mounted and fluid-damped. The pressure *versus* time record is engraved upon the surface of a rotating polished metal disc by a stylus fastened directly to the diaphragm. The record may be read with a precision of better than 1% of full deflection. The instrument will record pressures up to 1000 p.s.i. at frequencies up to 500 c.p.s. (Author's abstract.) H. C. E.

816. Self-contained Recording Pressure Gauge. D. R. Brown, W. C. Galloway, J. B. Robertson, and G. A. Silvey. *Rev. sci. Instrum.*, 1949, **20**, 27–30.—This instrument, of sturdy manufacture, can record pressures up to 1200 p.s.i. at frequencies up to 200 c.p.s. over a period of 5 sec. The pressure-sensitive element is a rigid peripherally mounted circular diaphragm damped with sponge-rubber pads. The pressure *versus* time curve is obtained by operation of a stylus attached directly to the diaphragm, against the flattened portion of a plunger which is driven at constant speed by the action of springs against grease which is forced through a small orifice. The plunger movement is initiated by the action of the pressure wave against the diaphragm through an electrical circuit. A record is given of the effect caused by the sudden closure of a check valve in water flowing in an 8-in pipe. H. C. E.

Safety Precautions.

817. Toxicity of Methyl Bromide. H. Wyers, O. C. de C. Ellis, and J. D. Birchall. *Industr. Chem.*, 1949, **25**, 206–207.—Correspondence. Dangers attending use of methyl bromide are emphasized by the last two writers, who support the view that its use should be prohibited in inhabited localities. Symptoms of poisoning are described; it is pointed out that the toxic concn is much lower than that required to suppress fire. E. B.

PRODUCTS.

Chemistry and Physics.

818. Organic Compounds of Fluorine. M. Stacey. *Industr. Chem.*, 1949, **25**, 112–116.—Methods of fluorinating aliphatic and aromatic substances and some of the properties and possible uses of the products are discussed. " Perspex "-type elastomers, resins, and lubricants, and many types of simpler substances have been made. The lubricants show rapid change of visc and density with temp, some have the characteristics of E.P. lubricants. Surface tension and n of fluorocarbons are lower and the visc greater than the parent hydrocarbon. E. B.

819. Critical Constants, Density and Viscosity. A. Boas. *Industr. Engng Chem.*, 1948, **40** (11), 2202–2203.—The law of corresponding states is applied to some equations relating various physical properties. Reduced equations are obtained and, thereby, a means of estimating crit. consts. Visc and density are considered here, although many others have been tried in the study. Values for the consts are presented, and examples are given to show how the method may be applied. R. G. T.

820. Mixed Adsorbed Films on Oil–Water Interfaces. E. Hutchinson. *J. Coll. Sci.*, 1948, **3**, 521–529.—The number of molecules in an interfacial film composed of more than one component can be obtained from interfacial-tension measurements. The system n-octyl alcohol–benzene in contact with sodium dodecyl sulphate–water is described, and the interfacial tension is studied as a function of the concentration of the two solutes. By applying the Gibbs adsorption isotherm to the system, and assuming that the two phases are mutually insol., the surface excess of alcohol and dodecyl-sulphate molecules in the interfacial film can be calc. The properties of the mixed adsorbed films are intermediate between those of the pure components. H. C. E.

821. Films at Oil–Water Interfaces. 3. E. Hutchinson. *J. Coll. Sci.*, 1948, **3**, 531–537.—The interfacial tension, γ, has been measured of aqueous sodium-dodecyl-sulphate solutions against *cyclo*hexane, benzene, nitrobenzene, and chlorobenzene at

23° C, and the results plotted against the freezing-point depression of the aqueous solution, θ. The surface excess of the dodecyl sulphate, Γ, was calc from the equation $\Gamma = \frac{N_s}{N_0} \cdot \frac{T_0^2}{LT} \cdot \frac{\partial\gamma}{\partial\theta}$, where N_s and N_0 are the mole fractions of solute and water, T and T_0 are the temp of the experiment and freezing point of water, and L is the latent heat of fusion of water. From the force–area curves for the adsorbed detergent films it is shown that the film is more condensed at the nitrobenzene–water interface than at any other, the order being nitrobenzene > air > chlorobenzene > benzene > *cyclo*hexane. The properties of air– and chlorobenzene–water interfaces are similar. The generalization made previously (see Abstract No. 1422 [1948]) is therefore invalid.

H. C. E.

822. Semi-Logarithmic Entropy-Volume (S-log V) Diagrams for Interpreting Test Results. R. Vichnievsky and B. Salé. *Rev. Inst. franç. Pétrole*, 1948, **3**, 319–327.—A S-log V diagram has been constructed, based on the data of Kühl (*Forschungsheft*, 1935, **6**, 373) for a gasoline having H 14·4% and C 85·6% (mean mol. wt. 100). Five mixture strengths are considered and variation of sp. ht. with temp and dissociation const are taken into account. Isobar, isoenergetic, and isotherm curves are drawn permitting the temp, internal energy, and enthalpy of the resulting gases to be obtained. Theoretical cycles can thus be calc, and an example is given. The chart is not limited to the gasoline used as basis, since small changes in fuel composition result only in negligible difference in the thermodynamic characteristics. V. B.

823. Applicability of the Eykmann Equation (an investigation using the best modern data). R. R. Dreisbach. *Industr. Engng Chem.*, 1948, **40** (12), 2269–2271.—The Eykmann equation relates the density and refractive index of a compound. The accuracy of experimental determinations can therefore be checked for various temps. The exact range over which the equation is applicable is not established, but a range of 10–50° C is recommended provided this range does not approach too near a f. p. or include a transition point. R. G. T.

824. Influence of Diffusion on Flame Propagation. A. C. Gaydon and H. G. Wolfhard. *Proc. roy. Soc.*, (A) 22.2.49, **196** (1044), 105.—For stationary pre-mixed flames of hydrocarbons, at pressures varying from a few mm. to 1 atm, calculations were made on relation between rates of diffusion, flame thickness, and flame speed, and compared with experimental values. The authors conclude that flame propagation is accounted for by diffusion of free atoms or radicals, and that the thickness of the reaction zone, which varies inversely with pressure, is related to the distance which free hydrogen atoms may diffuse against the gas stream. Calculation and experiment both indicate that flame speed is practically independent of pressure. The low temperature of the ignition point and the short induction periods required support the view that a purely thermal theory of flame propagation is inadequate.

There are eight literature references. W. M. H.

825. Free Energy of Formation of Molecules and the Anti-Knock Properties of Alkanes, Alkenes, and Alkynes. A. S. Irisov. *Neft. Khoz.*, 1948, (12), 25–32.—O.N. of alkanes decreases with an increase in their free energies of formation from the elements (at 25° C), the amount of decrease diminishes with increasing branching of the mol. Calculation from a graph gives good agreement with experimentally (motor method) determined O.N., which is better than that obtained by previously suggested calculation methods; comparative results are given. The relationship between free energies of formation and O.N. also holds for alkenes and alkynes, and the available data are tabulated. Anomalous results for the O.N. of the lower alkenes are reflected in their free energies of formation at 25° C, but if the free energies at 600° K are compared with the crit C.R. such anomalies tend to be evened out. V. B.

826. Critical Constants of *n*-Alkanes. M. D. Tilicheev and V. M. Tatevskii. *Neft. Khoz.*, 1948, (12), 33–35.—From an examination of the literature data the following equation is derived for the crit temp of the *n*-alkanes :—

$$T_{crit} = 164{\cdot}81 + \frac{93{\cdot}6659n}{1 + 0{\cdot}10651n}$$

where n = No. of C atoms in the mol. This expression gives values within 0·03% of those found experimentally. Using this equation values were calc by interpolation for the C^9–C_{11} compounds, these are considered accurate within 0·5° C, whilst the values extrapolated for the C_{13}–C_{20} compounds may vary from the true figure by more than 1° C. The expression $P_{crit} = -0{\cdot}082268T_{crit} - 71{\cdot}60$ is derived for the crit pressure of the n-alkanes and is accurate to 0·4%. The ratio of the b. p. to the crit temp for the n-alkanes increases steadily from 0·66 for n-pentane to 0·81 for n-eicosane.
V. B.

827. Pyrolysis of Carotene. R. N. Jones and R. W. Sharpe. *Canad. J. Res.*, 1948, **26** B (10), 728–733.—The formation of 2 : 6-dimethylnaphthalene from the pyrolysis of carotene is confirmed, but no more complex polynuclear aromatic hydrocarbons were isolated. D. F. J.

828. Recent Advances in the Chemistry of Hydrocarbons. D. S. F. Birch. *Nature*, 1949, **163**, 272–274.—The increasing use of high-performance aviation fuels has stimulated research into methods for producing *iso*-paraffins in large quantities. Of greatest importance are isomerization and alkylation.

Satisfactory cats for paraffin isomerization are the aluminium halides, promoted by hydrogen or alkyl halides, O_2, water, or olefins. It is found that the most effective cat is an equimolar mixture of aluminium halide and water, and by using D_2O instead of H_2O a reaction mechanism has been worked out :

$$CH_3CH_2CH_2CH_3 + DOAlBr_2 \rightarrow CH_3CH_2CHBrCH_2 \rightarrow (CH_3CH_2\overset{+}{C}HCH_3)Br^- \rightarrow$$

$$CH_3CH_2CH_2CH_3 + [(CH_3)_2\overset{+}{C}CH_2]Br^- \rightarrow CH_3CH_2CHBrCH_2 + (CH_3)_2CHCH_3.$$

Alkylation can be achieved either thermally or catalytically. The former process is limited in scope, but 2 : 2-dimethylbutane has been produced from *iso*butane and ethylene. Cats normally used are, in order of importance, H_2SO_4, HF, and $AlCl_3$, but the latter will produce 2 : 3-dimethylbutane from *iso*butane and ethylene. The products of acid alkylation of *iso*butane with butenes are a complex mixture of *iso*-paraffins of wide boiling range, and under favourable conditions the major part has the desired properties.

The production of triptane by two different routes, from trimethylethylene and from 2 : 2 : 3-trimethylpentane, is described.

The dehydrogenation of butane to butadiene is carried out as a two-stage process, butenes first being obtained over a chromium-oxide–alumina cat; then the purified butenes being further dehydrogenated in the presence of 10–20 vols of high-temperature steam. Ethylbenzene has been dehydrogenated to styrene under similar conditions. Likewise thiophenes can be obtained from sulphur and C_nH_{2n+1} ($n > 4$).

Reactions of paraffins with oxygen and SO_2 with acetic anhydride in ultra-violet light to yield sulphonic acids; the reaction of olefins and halogenated methane in the presence of peroxides (telomerization); the addition of H_2 and CO to olefins with cobalt cats (OXO synthesis); are briefly described. The use of copper acetylide in the formation of butine-1 : 4-diol from acetylene and formaldehyde and of nickel catalysts in the polymerization of acetylene to *cyclo*-octatetraene are mentioned.

The paper includes a list of twenty-two references. H. C. E.

829. Knocking Characteristics of Hydrocarbons. W. G. Lovell. *Industr. Engng Chem.*, 1948, **40** (12), 2388–2412.—Available data on the knocking behaviour of pure hydrocarbons are reviewed and tabulated. Most of the data are those obtained by A.P.I. Research Project 45. The data on knocking characteristics are critically reviewed, and correlations are discussed among various methods of test, sensitivity, blending values, mol structure, and susceptibility to T.E.L. R. G. T.

830. Reactive Structures of Hydrocarbons and Catalytic Hydrogenation. A. Maccoll. *Nature*, 1949, **163**, 138.—From consideration of the spins of " free " electrons in the carbon atoms of a reactive molecule, its energy E_r may be expressed as $(1{\cdot}5 + n_r - n_p)\alpha$, where α is the valence-bond-exchange integral and n_r and n_p are the coefficients of α in the resonance energy expressions for the reactant and product respectively.

The ease of cat hydrogenation of an isolated double bond follows because $n_\gamma = n_\beta = 0$, and E_γ is low. In benzene, however, $n_\gamma > n_\beta$ and E_γ is therefore high; but if two hydrogen atoms are added, E_γ for a further addition is considerably decreased. The relative indifference to the position of addition for butadiene is explained by the fact that E is the same for both $CH_2{:}CH{\cdot}CH{:}CH_2$ and $\cdot CH_2{\cdot}CH{:}CH{\cdot}CH_2$. H. C. E.

831. Empirical Heat Capacity Equations for Gases and Graphite. H. M. Spencer. *Industr. Engng Chem.*, 1948, **40** (11), 2152–2154.—Empirical heat-capacity equations have been obtained for solid graphite and 117 gases in the hypothetical ideal state at 1 atm, mostly between 293° and 1500° K. They include paraffins, mono-olefins, acetylenes, alkylbenzenes, *cyclo*pentanes, and *cyclo*hexanes. Other miscellaneous gases are acetaldehyde, boron tribromide, boron trichloride, boron trifluoride, ethanol, nitric oxide, styrene, and several methyl styrenes. The heat capacities of the former normal series increase regularly per CH_2 group added beyond the first three or four, and the heat capacity increment per CH_2 may be represented by :—

$$Cp^\circ = 1{\cdot}572 + 15{\cdot}95 \times 10^{-3}T - 50{\cdot}69 \times 10^{-7}T^2$$
or $$Cp^\circ = 0{\cdot}435 + 21{\cdot}148 \times 10^{-3}T - 117{\cdot}03 \times 10^{-7}T^2 + 2{\cdot}503 \times 10^{-9}T^3.$$

General empirical equations for heat capacities in the ideal state at 1 atm are presented for members with more than eight carbon atoms. R. G. T.

832. Mercury Photosensitized Reaction of Tetrafluoroethylene. B. Atkinson. *Nature*, 1949, **163**, 290.—When tetrafluoroethylene is irradiated by light of wavelength 2536 A a white powder, believed to be polytetrafluoroethylene, a gas believed to be hexafluoro*cyclo*propane (I), and a small quantity of other compounds are formed. The quantum efficiency of production of I increases with increasing pressure and decreasing intensity, and a reaction scheme accounting for this and other factors is given. It is surprising that the 112 k.cal/g. mol available from the excited mercury atoms is sufficient to rupture the C–C bond, which in C_2H_4 is stated to be 153 k.cal/g. mol. The reaction described may be contrasted with the mercury photosensitized reaction of C_2H_4, in which the primary products are hydrogen and acetylene. H. C. E.

833. Thixotropic Behaviour of Petroleum Jelly. A. de Waele. *Nature*, 1949, **163**, 248.—The apparatus comprises a 100-ml measuring cylinder with a perforated disc fitting inside which is provided with a central metal rod terminating in a ring. The system is prepared by pouring molten petroleum jelly into the cylinder with the plate at the bottom and leaving to set. When the plunger is worked slowly in the lower quarter of the cylinder a point is reached when, if the system is suspended from the ring, a steady rate of travel of the disc through the sheared zone can be obtained. The consistency, measured by the speed of travel of the disc, reaches a constant value after repeated experiments. When the jelly is sheared by working the plunger as quickly as possible the increase of rigidity is such that the system is stable when suspended from the ring. The transformation from high to low consistency can be repeated as often as desired.

The unsheared material shows thin, needle-shaped crystals under polarized light; the slowly sheared material shows many more crystals, resembling short double cones in shape; whilst the quickly sheared jelly again shows needles, but of shorter length. H. C. E.

834. Vibration Spectra of Hydrocarbon Molecules. I. Frequencies Due to Deformation Vibrations of Hydrogen Atoms attached to Double Bond. N. Sheppard and G. B. B. M. Sutherland. *Proc. roy. Soc.*, A, 22.3.49, **196** (1045), 195.—Characteristic frequencies in the region between 1500 and 700 cm^{-1} have been determined for alkyl-substituted ethylenes from infra-red and Raman spectra. Mean values of frequencies for various types of substitution are given, and have all been assigned to specific modes of vibration; the higher frequencies (>1000 cm^{-1}) are concerned with motions in the plane of the ethylenic double bond, and the lower frequencies arise from motions out of that plane. A theory is evolved for the persistence of these frequencies, and calculations made of the force constants involved.

When the alkyl groups are replaced by halogen atoms, variations in certain of these frequencies are shown to be due to changes in the force constants not in the masses of

substituents, the force constant decreasing progressively with increasing electronegativity. It may prove profitable to use these methods to follow changes in the electronic structure of the double bond with substitution.

There are forty-eight literature references. W. M. H.

835. Selective Hydrogenation. H. I. Waterman. *Chim. et Ind.*, 1949, **61**, 125–133.—A review in some detail of previous published work by the author and others on the hydrogenation of fatty oils and of naphthalene. V. B.

836. The Second Virial Coefficients of Organic Vapours. J. D. Lambert, G. A. H. Roberts, J. S. Rowlinson, and V. J. Wilkinson. *Proc. roy. Soc.*, 22.2.49, **196**, 113.—Graphs are presented showing the compressibilities of organic vapours measured at pressures up to 1 atm and temps from 40° to 130° C. Observed second virial coefficients are compared with values calc from crit data from the Berthelot equation, the validity of which is examined for polar and non-polar vapours. Compounds investigated proved to be of two types: (1) in which measured and calc vals for second virial coefficients are the same; (2) in which measured vals are much higher than those calc. The authors explain (2) on the theory that vapours of polar substances for which energy of attraction between molecules is larger than kT undergo dimerization. Thermal-conductivity data support this view.

There are seventeen literature references. W. M. H.

Analysis and Testing.

837. Note Describing an Apparatus (Houdry) for Measuring the Activity of Cracking Catalysts. M. Lafitte and T. Reis. *Rev. Inst. franç. Pétrole*, 1948, **3**, 328–334.—A detailed description, with drawings, is given of a laboratory cracking apparatus for cat evaluation, made to the design of the Houdry Process Corpn. Using a standard cracking stock (E. Texas gas oil) which is passed over a fixed cat bed the yields of products obtained (gas, gasoline, coke) are compared with those from a cat of known activity. Operating procedure is described; the yield repeatability of the test is $\pm 1\%$ for gasoline (210° C E.P.), $\pm 0{\cdot}5\%$ for gas and $\pm 2\%$ for coke. A table gives comparative data for this test and five other recognized test methods for determining cat activity. V. B.

838. Correlating Vapour Compositions and Related Properties of Solutions. (Use of Critical Constants.) D. F. Othmer and R. Gilmont. *Industr. Engng Chem.*, 1948, **40**, 2118–2124.—By logarithmic plotting, equilibrium conditions of temp, pressure, and compositions of liquid and vapour phases can be expressed as a sheaf of straight lines. The correlation is excellent throughout the entire range including the crit. Lines of const composition in the liquid phase are plotted on logarithmic scale as relative volatilities against the ratio of sp. vol. of vapour to sp. vol. of liquid. The lines were straight for the binary systems studied, allowing interpolation and extrapolation of experimental data. Other methods of logarithmic plotting are described for special cases, but these do not always give a straight-line correlation. The method of correlation of equilibrium data is to make a plot of logarithm of relative volatility against logarithm of total pressure of a reference substance at the same temp, pseudo relative volatility plot, or volume ratio plot, whichever first gives a straight-line correlation. R. G. T.

839. Method of Studying the Gas Content of Rocks. M. M. Elinson. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1949, 269–282.—A laboratory apparatus, consisting of a ball-mill operating under vacuum, is described whereby the gas content of rocks may be determined. Rock samples of ½–1 kg are used, and gas evolution therefrom is complete after 7–12 hr grinding at room temp. With proper attention to technique, accuracy can attain 97–98%; for routine purposes it is somewhat lower. Sixty-three rock samples (sandstones and shales) from coal mines were examined. Porosities varied from 1 to 14%, and gas yields per kg rock were 30–1000 cm^3. All the gases contained N_2 (10–95%), whilst CO_2, H_2, and CH_4 contents varied from nil to 30, 39, and 36% respectively. The rate of liberation of gas from the rock on grinding was studied, and gives an indication of the rate of such liberation under practical conditions. V. B.

840. Recent Developments of Mechanical Laboratory Test Methods for Lubricants. R. Le Bras. *Rev. Inst. franç. Pétrole*, 1948, **3**, 335–347.—A review of recent work (British and American) on the practical testing of lubricants. Engine tests (C.R.C. and Lauson) are described, and an account is given of grease-testing methods (A.B.E.C. and C.R.C.). A short outline of the principle of hypoid gears is followed by a description and discussion of the principal tests for E.P. oils (Almen, Falex, Timken, Four Ball, S.A.E., and the two C.R.C. full-scale tests). Twenty-three references.

V. B.

841. Lubricating Oil Tests. D. Downs and J. H. Pigneguy. *Automobile Engineer*, Feb. 1949, **39** (511), 51.—Methods of assessing performance of oils in road-vehicle engines by accelerated laboratory engine tests are discussed. The principal factors considered are :—

(1) formation of carbon on the piston;
(2) deposition of " cold sludge " in the crankcase rocker box, timing case, etc.;
(3) corrosion of bearings;
(4) cold corrosion of the cylinder liner and piston rings;
(5) piston-ring sticking.

The use of additive-type oils, heavy duty for diesel engines, and lighter duty for " premium oils " for less arduous duties in petrol engines, and their testing on a merit-rating basis has been developed.

A single-cylinder overhead-valve water-cooled petrol-engine of 4 in bore × 5 in stroke, operated with a cylinder temperature of 200° C and an oil temp of 95° C, is used for evaluating. (1) A fairly dirty piston on a good, straight-mineral oil is obtained in 50 hr running. The pistons are photographed by a special lighting and camera rig to provide a permanent record and a means of grading oil according to the area free from carbonaceous deposits.

For (2) an engine of similar dimensions is used, but with side valves instead of overhead valves. Low operating temps and a small quantity of oil in circulation are employed to accelerate deterioration. Two sludge-collecting surfaces, (*a*) a water-cooled crankcase door, and (*b*) the valve-chest cover, are employed. A test duration of 200 hr is required for evaluation of a straight oil.

For (3) an engine similar to that used for (1) is employed. An oil temp of 100° C and a high rate of oil circulation (140 g.p.h.) gives rise to measurable corrosion in 90 hr. Test pieces are fitted to the crankcase door to serve as " witnesses " that bearing loss is due to corrosion and not wear. Tests are undertaken with 70–30 copper–lead alloy bearings, the lead being attacked preferentially.

Investigation of (4) is carried out in a special cross-head engine so that separate lub. oils can be supplied to cylinder and crankcase. Only the oil used for the cylinder is examined for iron content. A reduction in coolant temperature from 65° to 16° C increases total wear ten-fold and ring wear twenty-fold. The influence of additives and T.E.L. in the fuel in this respect are shown.

Ring sticking (5) is carried out in a 250-c.c. J.A.P. motor-cycle engine operating at 3000 r.p.m. with wet sump and total-loss oil system. The test period is 5 hr, the cylinder temperature being raised in successive tests until the top piston-ring becomes stuck in its groove round a quarter of its circumference. The influence of additives and oil-consumption rate in this respect are also discussed.

Eighteen figures are given.

H. S.

842. Superfractionation Studies. (Naphtha from Crude Oil.) F. G. Schwartz, R. M. Gooding, and B. M. Ecclestone. *Industr. Engng Chem.*, 1948, **40** (11), 2166–2169.—Naphtha from a Santa Barbara, Venezuela crude was superfractionated into 0·5% fractions. The O.N. of both C.R.C.-F.2 (clear) and C.R.C.-F.3 (4 ml T.E.L./gal) were determined for each fraction. A plot of the O.N. against the sum per cent distilled indicates b. p. at which cuts can be made in refinery superfractionations, and the effect on resulting products. Analyses of the 0·5% fractions with their octane ratings provide data for calculating the blending O.N. of hydrocarbons. The blending Nos. can be used to calc the O.N. of naphthas having boiling range from 97° to 243° F using laboratory superfractionations and refractometric analysis. (The composition becomes indeterminate above this range, but some values for type hydrocarbons are given up

to 320° F.) The data derived from Santa Barbara naphtha confirm previously reported data which include both composition of naphtha and O.N. of gasoline derived from crude oil studied. R. G. T.

843. Accelerated Weathering. Tests for Assessing the Durability of Paints and Kindred Materials. F. Fancutt. *Paint Technol.*, Mar. 1949, **14** (159), 106.—Assessment of paint durability by accelerated weathering is based on the exposure of paint to the combined effects of ultra-violet light (from an enclosed carbon lamp), water, and a warm saturated atmosphere (relative humidity 100%) into which sulphur dioxide is passed. The apparatus is described, in particular a new form embodying the results of past experience obtained at the Scientific Research Dept, Paint Laboratory.

A single cycle will not usually give sufficient data, a series of three cycles is suggested to correspond with rural, industrial, and highly corrosive conditions. The end-point of the test should coincide with conditions at which repainting would occur. In all cases it is essential to expose a paint of known performance for comparison. Full account must be taken of interrelationship of the various coatings.

Special features of the new machine include large capacity per unit floor space and flexibility of operation. It is possible to vary speed of rotation, the distance between lamp and specimen, and number of lamps (1–4) opposite upper rack. Water sprays specially designed to give uniform wetting, and to control max temp of specimens. Though only used for a short period, results are comparable with those obtained from previous machine. D. K.

Gas.

844. LP-Gas Sales Continue to Gain in 1948. K. W. Rugh and E. O. Mattocks. *Petrol. Engr*, Jan. 1949, **21** (1), C-19.—The total volume of liquified petroleum gas marketed in 1948 is estimated at 2600 million gal which is a 29·5% increase on the 1947 figure. Domestic requirements are 1540 million gal in 1948 an increase of 33·9% on 1947, and there have been corresponding increases in the requirements for gas-making, industry, natural-gasoline manufacturing, and chemical manufacturing. G. K. A.

Engine Fuels.

845. Synthetic Liquid Fuels. *U.S. Bur. Mines Rept. Invest.* 4458, Jan. 1949.—This comprises Parts III and IV of the U.S. Secretary of the Interior's annual report on synthetic liquid fuels. Part III is concerned with liquid fuels from agricultural residues, while Part IV reports progress on secondary recovery, petroleum chemistry, and refining research. G. S.

846. Trends in the Application and Maintenance of Turbo Jets. Kroon and Rogers. *Aero. Engning Review*, Mar. 1949, **8**, 42.—The performance of fuel and lubricating systems in reciprocating engines and turbo-jet engines is compared with service experience on the other components of the engines. I. G. B.

Gas Oil and Fuel Oil.

847. Colloidal Fuel. R. A. Acton Taylor. *I.P. Review*, Mar. 1949, **3** (27), 83.—Colloidal fuel is pulverized coal suspended in fuel oil. Oil supplies can be augmented by use of colloidal fuel, which combines some of the respective advantages of coal and oil. It has many favourable points providing suspension is stable, but colloidal fuel is useless if coal settles too quickly because of deposits and blockages. Rate of sedimentation is affected by several factors listed in article. In America "stabilizers" are added to oils to improve stability of colloidal fuel. This is unnecessary in Britain due to use of different fuel oils.

Many economic difficulties are attached to use of "stabilizers." Assessment of stability of colloidal fuel is by oscillating a test-tube of the sample pendulum fashion and noting rate of sedimentation. Rate of sedimentation decreases as coal content increases, but there is upper limit due to handling difficulties. Generally 40 parts coal to 60 parts oil. The finer the coal the more stable is the colloidal fuel, but economics

limit production of very fine coal. Equipment for handling and burning oil needs little adaptation for burning colloidal fuel, although ash may make its use impracticable. Many tests on use of colloidal fuel have enabled fair comparison to be made with fuel oil, but further experience and extensive tests are still required. A. S.

Lubricants.

848. Lubricating Aerosols. K. C. Mosier. *Lubrication Engng*, Oct. 1948, **4**, 217–219.—The development of air–oil fogs as lubricating media for compressed-air cylinders is described, and their application to the lubrication of high-speed spindle bearings is outlined and the mechanism of the process discussed. Further applications are enumerated, and special advantages accruing from the use of aerosols in drawing and stamping operations are indicated. J. G. H.

849. Mechanism of Action of Bearing Corrosion Inhibitors in Crankcase Lubricants. J. D. Guttenplan and C. F. Prutton. *Lubrication Engng*, June 1948, **4**, 125–131.—The mechanism of corrosion of copper–lead connecting-rod bearings is described, and the possible modes of corrosion-inhibitor action are enumerated. Results are reported of a series of tests with five commercial bearing corrosion inhibitors which function by destroying oxidizing agents in the oils or by building up surface films on the bearing metal. The reaction of lead compounds from crankcase oils with some inhibitors, resulting in the promotion of oxidation, is also discussed. J. G. H.

850. Corrosion Preventives and their Assessment. D. L. Samuel. *Scientific Lubrication*, Jan.–Feb. 1949, **1**, 2–4, 22.—The functions of temporary protective agents in rust prevention are described, and dewatering fluids and the assessment of their water-displacing and protective properties are discussed. Industrial applications are enumerated and an accelerated evaluation test based on the contact angle between a water drop and an horizontal oil-covered panel is described. J. G. H.

851. Filtration of Insulating Oils through Adsorbent Materials. E. M. Kipp. *Lubrication Engng*, June 1948, **4**, 122–124.—Objections to the use of activated alumina as an adsorbent for the maintenance of power-system oils are discussed, and conditions affecting the efficiency of adsorbents are enumerated. Details are given of a series of tests on adsorbents, employing a modified A.S.T.M. turbine-oil oxidation cell, and the effect of oil temp during oxidation and the rate of flow of the oil through the adsorbent media are described. J. G. H.

852. Lubrication of Land and Marine Oil Engine. 2. Anon. *Scientific Lubrication*, Jan.–Feb. 1949, **1**, 17–20.—The advantages and disadvantages of mechanical lubricators are enumerated and design principles set out. Applications to horizontal and two-stroke engines are described, and lubricator timing is discussed. J. G. H.

853. Mechanism of Friction and Lubrication. J. J. Bikerman. *Lubrication Engng*, Oct. 1948, **4**, 208–216.—The mechanism of friction and lubrication are reviewed in accord with the " mechanical " theory, with details of variations with the " molecular " theory. Phenomena discussed include thin-film lubrication, transition to dry friction, scratching, cutting fluids, and resistance to sliding. J. G. H.

854. Mechanical Wear. J. T. Burwell, Jr. *Nature*, 1949, **163**, 262. (*Conference held at Massachusetts Institute of Technology, Cambridge, Mass.*, June 14–16, 1948.)—Topics presented at the meeting included laboratory and service experience on wear in I.C. engines, steam-turbines, journal bearings, gears, and cutting tools. Some of the factors controlling wear were considered to be hardness, fatigue strength, gas adsorption, chemical reaction, and visc.

The operation of rubbing surfaces under full-fluid, boundary, and dry lubrication was discussed, and the role of thick oil films in transmitting stresses was described. The corrosive wear of piston-rings increases with the sulphur content and the T.E.L. content (due to the presence of halogens) of the fuel, and also when the dew point of the combustion gas is reached. The role of fatty acids and graphite as lubricants was discussed. The failure of gear-teeth under exaggerated impact loading depends on

the viscosity of the lubricant, and not on its E.P. characteristics. The possible adsorption and chemical reactions which could take place between a rubbing-metal surface and its gas or lubricant environment were discussed. Information was given on the minimum oil-film thickness in a journal bearing just before failure, and it was shown that the electrical breakdown potential of the oil film often gave warning of impending failure. H. C. E.

855. Vapour Blast and its Effect upon Lubrication. Anon. *Scientific Lubrication*, Jan.–Feb. 1949, **1**, 16.—The effect of vapour blasting on the distribution of lubricants on bearing surfaces is described, and applications to zinc-alloy diecasting dies and cutting tools are outlined. J. G. H.

856. New Indices for the Viscosity–Temperature Relationship of Lubricants. G. H. Göttner. *Erdöl u. Kohle*, 1949, **2**, 17–23.—The significance of visc–temp relationship is explained, and sixteen systems previously suggested are listed. A connexion is sought between visc–temp behaviour and the lubricating process. The change in coeff of friction due to visc changes caused by temp variation is a measure of the significance of the visc–temp factor in lubrication. An expression is obtained for the temp modulus of the dynamic visc (M_η), where

$$M_\eta = 1000 \cdot \frac{V_4 + 0{\cdot}8}{V_4} \cdot \frac{m}{T} \cdot \log (V_4 + 0{\cdot}8)$$

in which m is the " orientation factor " of the Walther visc–temp equation. A knowledge of M_η is considered of value to engine designers and lubrication engineers. The higher the value of M_η the more the visc alters with temp. Comparisons are given of changes in M_η with visc (at 50° C) and similar changes for V.I. and pole-height. It is stressed that the visc–temp behaviour of different materials of the same type is not the same, a feature which is masked by the V.I. system. A relative visc–temp index, related only to one class of compounds (n-paraffins) is proposed and designated Paraffin Proportion (for dynamic visc) or Paraffin Relation (for kin visc). The index is given by

$$10 \cdot \frac{\text{visc–temp modulus (at } T^\circ\text{) of material on test}}{\text{visc–temp modulus of iso-viscous } n\text{-paraffin at } T^\circ}.$$

The Paraffin Proportion is given for a dozen organic liquids, values >10 indicate a visc–temp curve steeper than for pure paraffins and vice versa. A comparison of Paraffin Relation with pole-height is shown. The use of these constants is confined to liquids of low visc, and their utility is scientific rather than practical. For latter purposes and to cover materials of low and medium visc a further index, designated as the Normal Oil Relation, is suggested. This is given by

$$NR = 10 \cdot \frac{m}{m_N} \text{ where } m_N = 4{\cdot}3 - 0{\cdot}43 \log V_2 \text{ 50° C.}$$

NR has a value of 10 for " normal " oils and increases with increasing steepness of the visc–temp curve. A table gives some comparisons between NR and V.I. V. B.

Bitumen, Asphalt, and Tar.

857. Structure of Bituminous Materials. II. Solvation of Bituminous Materials. K. Krenkler. *Erdöl u. Kohle*, 1949, **2**, 11–16.—Nellensteyn's theory that the solvent power of a solvent with respect to bitumen is related to its surface tension is discussed and shown to be so full of exceptions as to be unacceptable. Bitumen solvents are reviewed, and the different behaviour of polar and non-polar solvents and their relation to solvation processes considered. The solubilities of coal tars are contrasted with those of bitumens. Unpublished work by the author on the adsorption affinity of organic solvents for charcoal shows that this is (in increasing order) gasoline, decalin, carbon tetrachloride, benzene, toluene, xylene, tetralin, chlorobenzol, chloroform, methylene chloride, pyridine, and that this is essentially the same order as that of their solvent power for bitumens. Some anomalies occur—for instance, the adsorption affinity of *iso*paraffins is less than that of the n isomers although their solvent power is greater. (Cf. Abstract No. 317.) V. B.

858. Hydrated Lime for Stabilising Roadway Materials. C. McDowell. *Rds & Streets*, Feb. 1949, **92** (2), 81.—Lime stabilization has been applied almost exclusively to granular flexible-base materials. "Waste" lime (80–100% moisture, 75% calcium hydrate) was employed. A 6-in thickness of old gravel road was scarified, air-dried, mixed with 3% lime (dry basis) by blading with maintainers, moistened, windrowed, bladed into 2-in layers, thoroughly compacted with a pneumatic roller, moistened a few days by sprinkling, dry cured a few days, and sealed with a bituminous surfacing. Such installations are in perfect condition after 2½ years. There are 60–75 miles lime-treated base in Texas. Limited frost-resistance testing has shown superiority to flexible pavements. Satisfactory results of lime stabilization are believed due to presence in many natural soil materials of pozzolanic (highly siliceous) substances, which react with lime solutions at ordinary temperatures giving stable cementitious compounds. Most successful results are obtained when certain clays are employed, In some cases, clay and lime are added to the granular material. Such mixtures have greater strength than lime–sand mortars without cement. R. H.

Special Hydrocarbon Products.

859. Liquid *iso*Propyl Alcohol. Enthalpy, Entropy, and Specific Heat from 6° to 200° C. D. C. Ginnings and J. R. Corruccini. *Industr. Engng. Chem.*, 1948, **40**, 1990–1991.—Measurements are described which extend the thermal data on liq *iso*propyl alcohol into a previously unexplored region. Enthalpy was determined by heating an enclosed sample of the capsule to a certain temp in a furnace, dropping it into an ice calorimeter and measuring the heat evolved in cooling the sample and capsule to 0° C. Sp. ht. was obtained by differentiation of the enthalpy–temp functions. Derived values of entropy and enthalpy from 0° to 200° C are given. R. G. T.

860. Liquefied Gas Insecticidal Aerosols. R. A. Fulton and A. S. Rohwer. *Soap and Sanitary Chemicals*, Feb. 1949, **25** (2), 122.—An insecticidal aerosol is defined as a system of particles suspended in air, where 80% of the particles are less than 30μ in dia, and none larger than 50μ, *i.e.*, the particles should remain suspended for approximately one hour. A typical aerosol consists of pyrethrum extract and D.D.T., *cyclo*hexanone or methylated naphthalene, and Freon-D12.

Aerosols are discussed under the headings, household aerosols, greenhouse aerosols, and field aerosols.

Formulations for household aerosols are bound by many restrictions to ensure safety for the operator, and all ingredients must be non-toxic to man.

Many of these restrictions are unnecessary for greenhouse aerosols, where the chief problem is the determination of the tolerance of the plant to the various ingredients. Special precautions are required in the application of tetraethyl pyrophosphate. In the use of field aerosols progress is less marked than in the household and greenhouse types.

There are eleven literature references. W. M. H.

861. Experiments with Insecticidal Smokes for Indoor Use. J. R. Busvine and J. S. Kennedy. *Annals appl. Biology*, Mar. 1949, **36** (1), 76.—Insecticidal smoke generators, each containing either crude D.D.T. or benzene hexachloride, were tested in the laboratory and in practice. For the first week benzene hexachloride proved more toxic, but for the subsequent six months D.D.T. was more effective. Residual action was fairly good against bedbugs and mosquitoes on vertical surfaces, but poor on horizontal surfaces.

Field trials in kitchens between August and November gave a substantial reduction of flies for 11 weeks with D.D.T. and 2 weeks with benzene hexachloride. Both insecticides gave excellent results against cockroaches for 2–3 months.

The smoke generators are inferior to spray treatments in that they need careful precautions to prevent tainting of food and they are very wasteful, using twenty times as much insecticide as a spray. Labour and equipment costs, however, are lower, and they are easier to operate than sprays.

There are two literature references. W. M. H.

862. The Effect of Paper Layers in Oil-filled Cables. C. F. Proos. *Ingenieur*, 11.4.49, **10**, 15–21.—A study of voltage characteristics and oscillograms in oil-filled cables at high temperature has been made in the power laboratories of the Dutch cable works.

It is accepted that ions oscillating between paper layers fix the shape of this characteristic at lower voltages. The oscillograms lead to the assumption that the rise in characteristic at the highest voltage is due to the vibration of the paper layers.

A schematic wiring diagram for the measurement of pressure curves and power losses, eleven curves, and seven graphs illustrate the article. A. H. B.

863. Factors Affecting Toxicity in Formulating Chlordan Emulsions. Yun-Pei Sun, L. B. Norton, and W. A. Rawlins. *J. Econ. Ent.*, 1948, **41**, 751.—A basic formulation was used, consisting of 20 g chlordan, 77 ml kerosine, and 10 ml emulsifier A (a polyoxethylene sorbitol mixed fatty acid ester).

Conclusions were: (1) wetting ability on squash leaves was low when concentration of emulsifier in diluted emulsion was less than 0·1%; (2) the addition of 0·02–0·1% of sodium lauryl sulphate as spreader increased toxicity to aphids; (3) five brands of emulsifier gave very similar results; (4) toxicity increased with amount of chlordan only when sufficient emulsifier was present to emulsify all the toxicant in the formulation; (5) different types of solvent did not appear to affect toxicity, except that raw linseed oil was better than any others.

There are three literature references. W. M. H.

864. Varnish Pollution of Transformer Oils. G. Beavan, J. A. Cockburn, and C. N. Thompson. *Electr. Times*, 1949, **115**, 302–304.—A 79 days' test on a 1-kVA (250-V) transformer operating at 50% overload during 44 of the days (oil temp 104–110° C) and filled with a "B.30" oil to B.S. 148/33 resulted in the oil showing high neut. (0·9) and sap. (1·8) val. The breakdown voltage was >40 kV. These results are due to varnish dissolving in the oil at the high operating temp, no water (crackle test) could be detected. The formation of an insulating varnish "bridge" between the breakdown-test electrodes is described. Indications are that a temp of 80° C may cause coil varnish to affect oil stability. V. B.

Derived Chemical Products.

865. Petroleum Chemicals in Relation to the Textile Industry. E. S. Paice. *I.P. Review*, 1949, **3**, 54.—Cracking processes in petroleum industry have made possible the manufacture of a wide range of chemicals and make large contribution to progress in the textile industry where a multitude of organic chemicals is used. Synthetic fibres could not have been manufactured without the petroleum chemical industry. Production of organic chemicals from petroleum has increased enormously in recent years. Chief olefins from cracking are ethylene, propylene, and butylenes, from which are produced solvents, detergents, wetting agents, humidifying agents, plastics, fibres.

Production of synthetic detergents represents another major development in petroleum chemistry and often provides results superior to soap and other wetting agents made from natural oils or fats. Natural gas also used as raw material for petroleum chemical industry and by suitable treatment ammonia (manufacture of amines), carbon disulphide (manufacture of viscose rayon), acetylene (vinyl chloride and vinyon type of fibres), methyl chloride (preparation of methyl cellulose), formaldehyde, and methanol are produced. Production of aromatic chemicals is likely to be important in development of newer synthetic fibres, *e.g.*, nylon and Terylene. Also produced are toluene, cresols, alkyl phenols, *o*-xylene. For many years to come petroleum represents most attractive source of raw materials for chemical and allied industries, not least the textile industry. A. S.

Coal, Shale, and Peat.

866. Specific Solvents for Lower Rank Bituminous Coals. I. G. G. Dryden. *Nature*, 1949, **163**, 141.—Specific solvents for bituminous coals can be divided into: (1) aliphatic compounds containing at least one primary NH_2 group; (2) aromatic compounds containing a primary NH_2 group attached to an aliphatic side chain; (3)

certain heterocyclic nitrogen compounds. The effect appears to depend both on swelling of the coal structure and on solution, for many compounds will cause swelling but not solution. Kiebler's generalization that the amount of extract at a given temperature can be correlated with the internal pressure of the solvent does not hold in the case of ethylene diamine at 117° C, nor for pyridine and aniline. (See also Abstract No. 630.) H. C. E.

Miscellaneous Products.

867. Emulsions and Emulsification. A. E. Alexander. *J. Oil and Colour Chemists' Assoc.*, Feb. 1949, **32** (344), 51.—Study of the interface has yielded information unobtainable by classical methods of examination of the emulsion as a whole. Three main problems are considered: (1) adsorption of stabilizing agent upon an extended oil–water interface created by mechanical agitation; (2) desorption of the agent; (3) nature of stabilizing film.

At air–water interface adsorption of stabilizer is often considerably slower than predicted by diffusion theory, an anomaly accounted for by stearic hindrance of the hydrocarbon chains. Hindrance is less with adsorption from the aqueous phase at an oil–water interface owing to the attraction of the oil, but greater hindrance with adsorption from the oil phase appears to be due to association of the stabilizer molecules. Little work has been done on desorption, which also appears to be unexpectedly slow. The structure of the adsorped films is discussed; water-soluble detergent-type stabilizers yield monolayers, but oil-soluble soaps give visible polylayers. The stabilizing effect of proteins is also due to the formation of insoluble polylayers.

The practical and thermodynamic stability of the systems are considered.

D. K.

868. New Synthetic Alcohol from Gasoline is Developed for Plastics Industry. W. Clark. *World Petrol.*, 1949, **20**, (2) 44–45.—*Iso*-octyl alcohol is produced by the OXO process, in which heptene from the polymerization of unsaturated cracker-gas reacts with CO/H_2 (synthesis gas) to form octanal. Hydrogenation of the octanal at 3000 p.s.i. gives principally C_4–C_8 straight-chain alcohols with appropriate side chains. The octyl alcohols are in demand for the manufacture of plasticizers, particularly for polyvinyl chloride. E. B.

869. Modern Treatment of Tool Steel. A. Michel. *Ingenieur*, 11.2.49, MK. 13–24.—A general introduction and history of progress by France, Germany, and the U.S.A. The article covers the theory of transformation in steel, hot and cold treatment, glowing and costing. Eight photographs, thirteen charts, and seven tables are with the article. A. H. B.

Engines and Automotive Equipment.

870. Addition of Heat to a Gas Flowing in a Pipe at Subsonic Speed. Foa and Rudinger. *J. Aero. Sci.*, Feb. 1949, **16**, 84.—This is a mathematical paper showing how a given flow in a pipe is modified by the addition of heat. It has obvious applications to engine problems dealing with gas-turbine combustion chambers and ram jets. I. G. B.

871. Some Aspects of Automotive Design and Development. C. L. Goodacre. *I.P. Review*, 1949, **3**, 33.—It is suggested that orthodox four-stroke engine with poppet valves will be principal automotive engine for next fifteen years. Few cars will be propelled by turbines or "other devices." The side-valve engine in Europe is dying fast due to difficulty of raising compression above 7·5 : 1, cooling difficulties, servicing snags. There appears little future for supercharging except for sports cars and maybe heavy trucks due to complications and expense. It is suggested that compression ratios over 10 : 1 in new cars will not be in general use within fifteen years. Much depends on availability of high-octane fuels. This situation makes a square engine more attractive. The engine will stay at front of car, and ferrous metals will be main construction materials for many years.

Plastics will be used increasingly for low-stressed members. Many automatic trans-

mission systems are now under intensive development. T.E.L. will continue as chief anti-knock agent. Better exhaust-valve material than Silchrome I required for improved engine performance of future. Minimum valve life should be 50,000 miles. Valve rotators and automatic self-adjusting tappets are gaining ground. For passenger cars carburettor will be retained for some time, since cost prohibits use of direct injection. Light lubricating oils becoming accepted as correct practice. Detergent oils will probably completely replace non-detergent oils. A. S.

872. Internal Combustion Motors and Oil-Industry. H. M. Hohmann. *Voodrachten Koninklijk Instituut van Ingenieurs*, 1949, **1**, 1–100.—*Drilling.* Survey of the solutions for the coupling difficulties arising by shifting from steam to internal combustion as a source of power, plurality of units; conditions of weight reduction and mobility; roughly 100 h.p. needed per 1000 ft. drilling depth; great difference between needed maximum and average power. Thomassen 6 FA drilling motor allows of reducing r.p.m. to 25% of normal.

Production. All products, including gas (formerly used for steam generation) gaining technological importance and wages rising, internal combustion, using a fraction of the fuel needed for steam, became a sound proposition for stationary units too; weight in view of foundations not irrelevant; slow speed and horizontal arrangement seem to be preferable in the long run. Electricity making headway; for great capacities (Venezuela) steam-turbine generators; in Indonesia gas-motor-generation by mobile units of 500 kW; in future perhaps gas-turbine plants. For pipelines as a rule the Diesel-type. Some details concerning pipelines and pumping.

Refinery and technological industry. Here the internal-combustion motor is of less importance.

Transport. The use of tankers has been favourable to the general development of the internal-combustion motor for ship propulsion and even to some special developments: The use of admiralty fuel (non-distillate fuel) in motors has become possible. (Author's Abstract.)

873. By-Product Power via Topping Turbines. J. B. Glasby. *Oil Gas J.*, 10.3.49, **47** (45), 98.—A survey of the power equipment at the Philadelphia Refinery of the Atlantic Refining Company has been carried out in order to plan for additional steam and electrical power.

As a result, two new 125,000 lb/hr high-pressure (650 p.s.i. 750° F) boilers with attendant by-product power-generating equipment consisting of two 3500-kW back-pressure turbo-generators have been installed, and other boilers reconditioned to carry the remainder of the 165 p.s.i. steam load.

The boiler units and other power equipment are described. G. A. C.

MISCELLANEOUS.

874. Petroleum a Raw Material for Chemical Industry. J. C. G. Boot. *Chim. et Ind.*, 1949, **61**, 229–234.—Chemical raw materials from pet are classified as those already present in the crude (*e.g.*, H_2S, naphthenic acids, aromatics), primary materials (*e.g.*, products obtained by cracking and dehydrogenation) and secondary materials (*e.g.*, olefins). Brief notes regarding the principal members of each group are given, together with production statistics (for the U.S.A.) for some of the main compounds. A notable change in origin is in the case of CO (for CH_3OH synthesis) of which in 1946 71% was obtained from coal, whereas to-day 77% is yielded by natural gas. V. B.

875. Report of Petroleum and Natural Gas Division, Fiscal Year 1947. R. A. Cattell. *U.S. Bur. Mines Inf. Circ.* 7484, Dec. 1948, 65 pp.—Since the war the pet and natural gas division of the U.S. Bureau of Mines has been working on a co-ordinated programme of oil and gas development and production research. The results of this work during 1947 are recorded here. G. S.

876. Foreign Refineries Operate Above Capacity in 1948. *Petrol. Engr*, Jan. 1949, **21** (1), C-29.—A list is given of the country, address of the refinery, plant location, type and capacity, cracking capacity and type, crude intake, and synthetics. G. K. A.

877. Methods of Alleviating our [German] Fuel Shortage. W. Wilke. *Erdöl u. Kohle*, 1949, **2**, 71–74.—Substitute automotive fuels and their merits and disadvantages are considered. Factors of lost operating time, load, wear, and power output are assessed for solid and gaseous substitutes and, taking liquid fuels (gasoline and gas oil) to have an overall merit rating of 100, figures of 98, 86, and 58 are arrived at for liquid gas, compressed gas, and producer gas respectively. Future prospects of indigenous production and import of pet fuels are discussed, and it is concluded that producer gas still has an important part to play in fueling German vehicles. Hydrogenation of coal is, however, a better source of fuel than producer gas, and the consumption of materials in operating and re-equipping hydrogenation plants is less than in manufacturing and operating a large number of individual producer units. V. B.

878. Work of Soviet Scientists on the Destructive Distillation of Petroleum. S. N. Obryadchikov. *Neft. Khoz.*, 1948, (12), 53–58.—A review of Russian work on various type of cracking. Priority is claimed in respect of many developments. Cracking for the production of illuminating gas was practised in the 1870s, whilst aromatic hydrocarbons were produced by cracking in 1885, and in the early 1890s such were used as chem raw materials for the manufacture of aniline, etc. The scope of more recent U.S.S.R. work on cracking is outlined. Thirty-three references. V. B.

879. Recent Development of the Petroleum Industry. P. M. E. Schmitz. *Chim. et Ind.*, 1949, **61**, 179–183.—World production figures (by continents) are given for 1944–47 followed by a short summary of the main recent advances in the geology, production, and especially refining of pet, including cracking, aviation fuel manufacture, lubricants, and petrochemicals. After giving present consumption figures and forecasts to 1951, it is pointed out that, at present, the Eastern hemisphere has an excess of crude as compared to refining capacity, whilst the converse is the case for the Western hemisphere. V. B.

880. Simplified Approach to Preliminary Cost Estimates. H. J. Lang. *Chem. Engng*, 1948, **55** (6), 112.—The approach is based on the knowledge of delivered cost of equipment only. According to the type of process involved (*e.g.*, solid, solid–fluid, fluid-processes) the delivered equipment cost is multiplied by some pre-determined factor (generally between 3·0 and 5·0) to give the total estimated plant cost. Actual working examples are given, taken from new and existing plant, illustrating the close proximity of the result and that obtained by a detailed estimate. R. T. W. H.

881. Cost-imating Depreciation Rate—Petroleum. W. L. Nelson. *Oil Gas J.*, 10.3.49, **47** (45), 111.—No. 21 in the series tabulates years of useful life of development, marketing, production, and transportation (oil pipelines) equipment.

Items under the various headings include boilers, engines, meters, pumps, loading racks, treating plants, pipe-lines, vehicles, and pump stations. G. A. C.

882. Cost-imating Ladders, Walkways, and Platforms. W. L. Nelson. Oil Gas J., 17.2.49, **47** (42), 137.—No. 18 in this series gives tables showing costs of platforms for various-sized towers (2 ft 6 in to 13 ft) with weight in lb, steel and lumber costs for hand-rails, platforms, and ladders, etc., and cost and weight of ladders, walkways, etc. A table gives approximate cost indices for years 1924–48; for present estimate 1946 cost = 100. G. A. C.

883. Cost-imating. Depreciation Rates—Refining. W. L. Nelson. *Oil Gas J.*, 24.2.49, **47** (43), 187.—No. 19 in this series gives two tables. The first shows years useful life of refinery equipment—for example, agitators, cracking stills, exchangers, tanks, pipelines, and tools. Second table shows approximate life in years of refinery auxiliaries such as boilers, construction machinery, fire extinguishers, office equipment, and vehicles. G. A. C.

884. Drying of Temperature Sensitive Materials. H. A. Leniger. *Ingenieur*, 4.3.49, Ch-3 : 4.—Describes and discusses the relative merits of spray drying, drum drying, and freeze drying. A. H. B.

885. List of Fuel Prices. *Motor Ship*, Mar. 1949, **29**, 472.—Price of boiler and diesel oil is given for a very wide variety of ports. I. G. B.

886. Present Status of Government High-octane Aviation Gasoline Plants. G. Walker and W. C. Cope. *Oil Gas J.*, 17.2.49, **47** (42), 92.—Disposition of all but a few of the twenty-nine U.S. Government-built aviation-gasoline facilities is given. A survey gives details of plant in eastern, mid-continent, mountain, Texas, Louisiana, Arkansas, and California areas. Capacities, mode of operation, and purchaser, with price paid, are shown. G. A. C.

887. General Petroleum's Burrel Gasoline Plant Achieves High Extraction Efficiency. M. E. Garrison. *Oil Gas J.*, 10.3.49, **47** (45), 66.—The natural-gasoline plant of the General Petroleum Corporation in the Fresno area of California is described.

An 80% extraction level of propane potential and 90% of *iso*butane potential is achieved. The plant was designed to a capacity of 30,000 million cu. ft. per day of wet gas at three field pressures, viz., 50, 150, and 450 p.s.i.g. The plant delivers dry gas at 440 p.s.i.g. to a gas company, at 500–600 p.s.i.g. to another; and makes possible the extraction and retention of 85% of the *iso*butane and 70% of the propane content of the wet gas. Flow sheets are given for the absorption section, propane-cooling lay-out, and fractionating section. G. A. C.

888. Economics of Motorways. Anon. *Petrol. Times*, 28.1.49, **53**, 73.—This paper is a summary of the report of a joint committee appointed to consider the economics of motorways. The investigation was based on the operation of goods vehicles on a specimen route, between St Albans and Coventry. Estimated savings in vehicle-operating costs are compared with the costs of constructing motorways and of reconstructing existing roads. Neglecting any considerations of safety, convenience, and amenity, it is concluded that the economics justify the construction of motorways. C. G. W.

889. The Use of Silicic Acid Esters for Heat Transfer. E. D. Fano. *Ingenieur*, 4.3.49, Ch-1 : 3 (Article in English).—A general introduction to silicon-organic compounds and details of silicic-acid esters, their characteristics, and main features, stressing the high boiling points, low melting points, and resistance to decomposition, and a description of the points in their favour as heat-transfer media quoting the safe temperature limits.

A full description of an aryl silicate, T.A.S. (a mixture of several phenyl–cresyl orthosilicates) is given, with a note on its heat stability. A. H. B.

890. Tour of a Turnaround. Anon. *Oil Gas J.*, 24.2.49, **47** (43).—A twenty-six-day total time downtime turnaround of the Shell Oil Co.'s Houston Refinery's cat cracking plant is described. G. A. C.

891. A Tanker Trip to the Mexican Gulf. New U.S.A. Harbour Installations. J. de Coudiër. *Bull. Ass. franç. Tech. Pétrole*, 1949, (73), 25–37.—A lecture giving an account of tanker operation and describing (with map) the oil terminal at Corpus Christie, Texas. V. B.

892. Technical Documents Centre. H. Sangster. *Ingenieur*, 4.2.49, A50–51.—The institution of a "Technical Documents Centre" by the Economic Ministry was announced October 13, 1948. It is housed at Amsterdam, and works along similar lines to the London Board of Trade Technical Information and Documents Unit and to the U.S. Office of Technical Services. Present stock is about 18,000 reports of American, Canadian, English, German, and Japanese origin. The Universal Decimal Classification system is to be used, and monthly lists issued. A. H. B.

893. Drilling and Production in January 1948. H. Górka (Inż). *Statystyka Naftowa Polski*, Jan. 1948, 4. [Supplement to *Nafta*, March 1948, 4, 99.]—Figures are given for quantities of crude pumped, gas produced, unrefined gasoline obtained, and drilling operations in progress during January 1948. A graph is plotted showing crude and natural-gas production for 1947–48 together with their origin. Data for 1948 include January only. Some outstanding figures are also given. The monthly figures are: Crude, 11,275,000 kg; natural gas, 15,755,000 cu. m.; gasoline fraction, 731,922 kg; drilling 4435 in eighty wells.

The article is followed by four pages of comprehensive tables. M. S.

894. Power Wiring in Petroleum Refineries. W. H. Dickinson. *Oil Gas J.*, 24.3.49, **47** (47), 287.—The term power wiring refers to the conductor construction and the design and installation features of the conductors. It does not cover the type of distribution system or equipment elements such as switchgears.

The classes of refinery electrical loads, *i.e.*, the requirements for the processing units, products loading and unloading, pumping, offices, and stores, are shown as percentages of total loads.

The load data of a typical large refinery, covering running motors, standby motors, and miscellaneous loads (peak and average) are given in a tabulation and are discussed from the aspects of the type of standby service, *i.e.*, steam or electric, and the effect of interruptions of electrical service on the refinery operations.

Comparisons are given of the reliability of the types of wiring and the costs of installing: open wire, aerial cable, buried cable, and cable in conduit are widely discussed.

A comparison of radial feeder costs is given for the cases of: open wire, aerial cable, and underground cable; and a cost comparison is shown for three single-conductor cables for both 600-v and 5000-v service is shown and discussed. W. H. C.

895. A.P.I. Digests. Various. *Oil Gas J.*, 7.4.49, **47** (49), 96.—A symposium of the Refining Division meeting of the A.P.I. at Houston, April 4–7, 1949, is reported. Subjects dealt with include rapid methods of analysis, refining wastes, training programmes, and other subjects. G. A. C.

896. Reserves Natural Gas. G. G. Oberfell. *Oil Gas J.*, 17.3.49, **47** (46), 118.—Major U.S. reserves exist in certain large gas fields in the Permain basis of west Texas, the Panhandle Hugoton areas of the mid-continent region, the Gulf Coast, and the Appalachian area in California.

A table shows that the proved reserves of natural gas in the U.S. are 174 trillion cu. ft. as at 1.1.49, equivalent to a thirty-seven years' supply based on 1948 consumption.

It is expected that further exploration will add considerably to the proved reserves, and this will result in adequate natural-gas supplies for many years to come.

50% of the present annual marketed production of 5 trillion cu. ft. of natural gas is consumed in industrial applications, about 20% as domestic and commercial fuel, 20% at source in fields, and remainder in production of carbon black. Chemical uses, though of growing importance, do not as yet account for much gas. G. A. C.

897. List of Fuel Prices. *Motor Ship*, Mar. 1949, **29**, 472.—Price of boiler and diesel oil is given for a very wide variety of ports. I. G. B.

BOOK REVIEWS.

Alkylation of Alkanes: Volume I: Patents on Alkylation of Alkanes. Gustav Egloff and George Hulls. New York: Reinhold Publishing Corporation (American Chemical Society Monograph Series, 1948). Pp. xiv + 1138. 120*s*.

The importance of paraffin alkylation in the production of the 100-octane aviation fuels for use by the British and American Air Forces during the last war can be gauged from the statement made by the authors in the introduction that the daily production of alkylates reached 6,300,000 U.S. gal, which represented plant installation of about $200 million.

Although the alkylation of paraffins was first described by Ipatieff and Pines in 1932, it was not until 1936, when it was found that butenes and *iso*butane would combine under surprisingly mild conditions in the presence of sulphuric acid as catalyst to yield a product consisting largely of the valuable trimethylpentanes, that the importance of the process was fully recognized. In spite, however, of the early patent claims of Ipatieff and Morell with regard to sulphuric-acid alkylation, the technical development of this process was almost entirely due to a group composed of four major oil companies, viz., the Standard Oil Development Company, the Shell Development Company, the Texas, and the Anglo-Iranian Oil Company. This group had discovered sulphuric-acid alkylation independently, and through intensive research and development carried the process to the full scale in a remarkably short time.

The first commercial alkylation units were based on non-catalytic thermal operation. The drastic conditions of temperature and pressure required, together with the limited scope of this type of operation, did not encourage extensive development. With the discovery of the catalytic action of sulphuric acid and the ease with which reaction could be affected, alkylation became a process of major importance. Together, catalytic cracking and alkylation were capable of providing a satisfactory blend stock needing only the addition of T.E.L. to give a finished 100-octane fuel. The use of hydrogen fluoride as a catalyst was a later development. This acid offered certain advantages over sulphuric acid, particularly in respect to the lower requirements of critical material for plant construction and easier catalyst recovery. These advantages were, however, to a large extent offset by the fact that the acid leaving the sulphuric-acid alkylation units was still an effective refining agent for many refinery products.

The present volume dealing entirely with the patent literature summarizes over 800 patents covering the alkylation field from 1932 to the middle of 1947. This alone gives a clear indication of the importance attached to the process. Apart from the usefulness of a complete record of all the relevant patents on alkylation in one volume, the fact that many contain valuable information of a fundamental chemical nature renders this work doubly useful. The authors have made no attempt to indicate the relative values of the patents either scientifically, technically, or legally, a difficult thing to do in a work of this kind.

Unfortunately, through lack of subject and author indices, the work loses much of its usefulness, particularly as a book of reference for which it was primarily intended. Although the list of contents groups the patents into main classes including "Catalytic alkylation," "Thermal alkylation," "Combination processes" (including combined dehydrogenation alkylation or isomerization alkylation processes), "Miscellaneous processes," and "Selective dealkylation of alkanes," together with suitable sub-headings, it is extremely difficult to find any required patent unless the actual patent number is known. The index provided merely repeats the order in which the patents appear in the book. This index is not even in order of filing or of issue.

The inclusion of "selective demethylation" on the grounds that being dealkylation, it is the reverse of alkylation, is hardly justified. It could be argued that cracking, which can also involve dealkylation, should be included as well. In spite of its deficiencies with regard to indexing, this volume forms a valuable addition to

the series of chemical monographs, and no doubt when the remaining two volumes are issued will help provide a complete treatise on the alkylation reaction and process. S. F. B.

The Chemistry of High Polymers. C. E. H. Bawn. London: Butterworth's Scientific Publications Ltd., 1948. Pp. 249. 17*s*. 6*d*. net.

The text of this very useful and valuable introduction to the physics and chemistry of high polymers is based on a series of post-graduate lectures given in the University of Bristol to senior chemical students and to industrial chemists.

In effect, polymer chemistry is a new and rapidly growing subject. It covers a wide field of natural products of which rubber, cellulose, proteins are examples. Admittedly there are excellent treatises available on these various classes of high polymer, but there is obviously a need for a simple and effective explanation of the general principles applicable to all macromolecules. Such is the aim of the volume before us.

The chapter headings will give the general lay-out of the author's treatment: nature and types of polymer; condensation polymerization, addition polymerization; thermodynamics of solutions of high polymers; size and shape of macromolecules; structure, stereochemistry, and crystallinity of high polymers; structure and physical properties of high polymers.

The book is extremely well documented, each chapter being provided with its own particular series of references. The various formulæ are admirably displayed, and, in general, the get-up and typography are outstandingly good. A considerable debt of gratitude is owed to Dr Bawn, perhaps particularly from petroleum chemists, for a most informative treatise. A. E. D.

The Chemistry of High Polymers and Surface Chemistry. H. W. Melville and E. K. Rideal. Cambridge: W. Heffer & Sons, Ltd., for the Oil and Colour Chemists' Association. 1948. Pp. 76. 10*s*. net.

Two very distinguished men of science have collaborated in this series of post-graduate lectures to the Oil and Colour Chemists' Association, both of them eminent in the field of high-polymer research. Professor Rideal, whose school of colloid science at Cambridge was world famous, has now achieved the time-honoured chair at the Royal Institution, whilst Professor Melville of the University of Aberdeen has already been responsible for notable advances to the science of macromolecules.

It is surely a matter of congratulation to a technical association that their faith and courage in looking forward should have sponsored such a work as this in the difficult times between 1941 and 1945.

Professor Melville's three lectures are concerned with synthesis, molecular size, and molecular structure. He points out that although the study of the natural high polymers such as proteins, cellulose, rubber, and so forth, has led to many advances, yet the synthetic approach has the tremendous advantage that molecular size, shape, and composition can be varied without limit. And further, there is the advantage that the macromolecules can be perceived in the act of growing. The determination of molecular size is discussed from the angles of end-group analysis, osmotic pressure, viscosity, and light scattering.

Professor Rideal discusses surface chemistry and especially reactions at solid surfaces, such as adsorption by activated charcoal, chemi-sorption where there is true chemical interaction at the surface; activated adsorption; multilayer adsorption following on the formation of the first monomolecular layer; phase change, liquefaction of vapour at the surface, and capillary condensation.

Naturally the mechanism of catalysts at activated surfaces is dealt with to some detail, and this discussion is of considerable interest to the petroleum chemist.

The Fischer–Tropsch process is, for example, brought about by the interaction of chemisorbed materials. And naturally modern ideas of lubrication come into the picture.

Each and every progressive industry to-day lies at the mercy of the first wave, over the top, of scientific attackers—and even of hidden commandos. It is of little use sheltering behind the crumbling trenches of old practice.

Such works as this by real leaders of modern chemical thought need to be read and marked and certainly digested. A. E. D.

The Instrument Manual 1949. London: United Trade Press Ltd., 1949. Pp. vii + 548. 70*s*.

The Manual has been produced with the object of providing, under a single cover, detailed information on a most comprehensive variety of instruments manufactured in the United Kingdom. Of the twenty-one major sections, seventeen are devoted to the various types of instruments—precision, engineering, optical, weighing, pressure, level, temperature, etc., and the remainder to organizations, publications, and manufacturers associated with instrumentation.

It has been compiled by a number of authors, each possessing intimate practical knowledge of his own branch, and has been written to provide the type of information generally sought by the consumer. It is far more than a mere catalogue of instruments. In particular, recent apparata, such as the mass spectrometer and electron microscope, are described in detail, both as to theory and construction.

Another excellent feature included is the bibliography appended to each section, giving references to individual articles published during the past decade.

A separate section is included on the theory and application of automatic-control systems; and under each section, a buyer's guide is presented for each type of instrument described.

Further features include a complete directory of manufacturers and a useful advertisement section.

Thus the volume should interest all who select, order, install, maintain, and use industrial and laboratory instruments, and also students of instrumentation.

The inclusion of so many aspects under a single cover makes the volume good value for money.

The production is generally of excellent quality. The many line drawings and photographs are clear, and the manual is exceptionalyl well indexed and is adequately bound.

R. T. W. H.

The Systematic Identification of Organic Compounds. A Laboratory Manual. By Ralph L. Shriner and Reynold C. Fuson. 3rd Edition. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd. 1948. Pp. viii + 370. 13*s*. 6*d*.

This book, first published in 1935 and now in this, the third edition, is a student's manual intended to be followed systematically as a course of instruction on the identification of pure organic compounds. The arrangement of the book is good, and it is well bound and printed in clear type on good paper. The instructions given to the student, which are lucid and systematic, not only fulfil their chief function in indicating correct procedure but are also intended to train the student to develop his powers of reasoning and to draw correct deductions from the results of his experiments and careful observations.

The general scheme for the identification of an unknown compound is outlined in Chapter II. After the usual examination of the material with regard to physical state, odour, and behaviour on ignition, physical constants, such as melting point or boiling point, are determined. Chapter IV gives brief but clear instructions for the determination of melting point, boiling point, specific gravity, refractive index, and optical rotation. Tests for elements complete the preliminary examination. Use is then made of a unique system of classification by solubility, the solvents employed being water, ether, dilute solutions of caustic soda, sodium bicarbonate and hydrochloric acid, concentrated sulphuric acid, and 85% phosphoric acid. By this means the unknown compound can be placed in one of seven solubility classes. The effects of molecular structure, chain length, functional groups, etc., on solubility in the chosen solvents is discussed in Chapter VI. From a consideration of the results of the preliminary tests, the physical constants, and a knowledge of the types of compound in each of the solubility classes, the student should now be in a position to deduce the nature of the unknown and the functional groups probably present. He can then proceed to confirm his deductions by the use of the classification tests given in Chapter VII. Here a choice is given of thirty-six tests for the functional groups. The procedures for these tests are given in detail for typical compounds, and short discussions on the reactions involved and a few useful references to the literature are given. At this stage the student should be able to place the unknown

within a small group of compounds and is instructed how to prepare suitable derivatives for comparison of physical properties.

In Chapter VIII (sixty-six pages) fifty-three procedures for the preparation of derivatives are given; Chapter IX consists of tables giving melting points and/or boiling points (and in some cases specific gravities) of compounds and those of their derivatives. These tables, occupying sixty-six pages, are arranged alphabetically under types of compound, the compounds in each table being arranged in order of melting point or boiling point. In the chapter on the preparation of derivatives, useful advice is given on the choice of suitable compounds, and numerous references to the relevant literature (mainly American) are appended. The merit of these chapters on classification and derivatives is worthy of special mention.

The concluding chapters deal with separation of mixtures, brief notes on the interpretation of experimental results, and sets of problems for the student to solve from given data. There is an appendix giving lists of the equipment and reagents required. In the index, which is very clearly arranged to facilitate rapid reference, the melting point (or boiling point) of each compound is given beside the page reference.

In consideration of the amount of useful information it contains, this book is of reasonable price.

Apart from its use as a manual for instruction, this book should have some general usefulness for quick reference to methods for the preparation of derivatives; it is, however, most likely to remain of value as a reference book for those who have made a study of the authors' system. T. M. A. T.

Diesel Engine Design. T. D. Walshaw. London: George Newnes Ltd., 1949. Pp. 448. 35*s*.

Any single book would need to be very large indeed to deal adequately with all sides of such a comprehensive subject. The successful diesel-engine designer (the author uses diesel with a capital " D ") must have a sound knowledge of thermodynamics, combustion, mechanisms, inertia forces, vibrations, etc., besides a thorough grasp of the properties of materials and their resistance to different kinds of loading. On top of this he must have, in common with designers of other engineering products, a background of practical experience by which he is able to deal with the many problems that are not amenable to calculation. The author does not attempt to deal in a comprehensive way with all aspects, but wisely refers the reader to other works on such subjects as thermodynamics and torsional vibrations. He is then able to devote more attention to the practical problems of the engine designer than could otherwise be done in a book of 415 pages.

The book is divided into twenty chapters. The first five are general in character, dealing with thermodynamic principles, combustion, engine types, engine sizes, and general considerations in design. The next six chapters deal with the design of the important components, cylinder-liners, cylinder-covers, pistons, connecting-rods, crankshafts, and flywheels. Then follow chapters on balancing, air and exhaust systems, valve gear, fuel injection, governors, engine frames, and supercharging. Chapter 19 deals with a few miscellaneous items, and the last chapter gives a well-chosen selection of engine sections to represent modern practice.

Presumably the size of the book is limited by considerations of paper economy, and it might have been better to omit some of the subjects altogether in order to allow space to treat others more fully. For example, the first chapter, on thermodynamics, which needs a book to itself, is so elementary that it has little or no value to the engine designer, and the book would not suffer by its omission. On the other hand, engine balance is a very important problem in the designer's task, and this chapter should be longer and should cover more ground. Although the speed range of the engines described goes up to 1500 r.p.m., most of the examples are taken from the slow and medium-speed ranges, and the author points out that he does not cover the automobile applications. Nevertheless, it is surprising not to see some mention of the important problem of engine mounting, from the point of view of vibration prevention.

Apart from these points, the book is well balanced, and is up to date in its information and practical examples. Interesting features are the emphasis given to the

proper shapes of fillets, the stress analysis of a connecting-rod, and the method used for analysis of crankshaft loading.

The book is very readable, the diagrams and illustrations have been thoughtfully chosen, and the whole has been carefully prepared and is well presented. Altogether, this is a very useful addition to the literature of a difficult subject, and should find a ready place on the bookshelves of all who are interested in the design of diesel engines.

E. G.

BOOKS RECEIVED.

New Mexico Oil and Gas Engineering Data for 1947. N. R. Lamb. Socorro: New Mexico Bureau of Mines and Mineral Resources, 1948. Pp. 279.

Transactions of the First Petroleum Congress. Alexandria: The Engineers' Society of Alexandria, 1948. Pp. 142 + 55.

Contains papers read at the Congress which was held at the Faculty of Engineering, Alexandria, April 15–18, 1948. Contents are: Recent developments in cracking petroleum, H. G. Shatwell (4 pp.); Significance of micro-organisms for petroleum research, S. W. Tromp (3); Application of additives to lubricating oils, M. Nabih Ibrahim (5); Transport and distribution of mineral oils, R. Batie (10); Petroleum chemicals, A. D. Cooper (22); Processing of petroleum, S. E. Al-Anwar (14); Petroleum exploration methods, F. Iskander (5); Use of electric power in oil-well drilling and production, M. S. Reda (5); Salt-water drilling fluids, K. el Sehrawy (5); Oil exploration in Egypt by gravity and seismic methods, J. Carr (14); Petroleum, a new raw material for chemical industries, K. Lauer (9); Theoretical and practical bases of modern gasolines, O. Pauer (12); Timber foundations for drilling derricks, F. K. Hanna (7); Lubrication, N. A. Blackmore (8); Petroleum process products and their use in industries, J. Verschulz (5); Dehydration and desalination of Egyptian crude-oil emulsions, M. Sadek (11); Relation between compaction and dielectric constant of rotors, H. Lowy (2).

There are seven papers in Arabic: The reduction of iron by petroleum, M. M. Omar (1); Increase of oil recovery, A. Defrawg (4); Petroleum tests and their relation, M. A. El-Halwagy (13); The progress in petroleum industry and its uses, I. Y. Moustafa (8); Mazout concrete tanks, S. Mortady (4); Fuels and lubricants for motor vehicles and tractors, M. S. Farid (10); Economic utilization of petroleum for power production in Egypt, M. A. El-Hakeem (14).

1948 Supplement to Book of A.S.T.M. Standards. Part I-A. Ferrous Metals. Pp. 261 + x. **Part III-A. Nonmetallic Materials.** Pp. 410 + x. **Part III-B. Nonmetallic Materials.** Pp. 330 + xiii.

These contain the 1948 revision of the A.S.T.M. test methods and specifications. Part III-A includes petroleum products and lubricants, while Part III-B incorporates electrical insulating materials.

Wear and Lubrication of Piston Rings and Cylinders. R. Poppinga. New York: American Society of Lubrication Engineers, 1948. Pp. 201.

This is a translation by Dr. E. Kurz of a book published in 1942 by the Society of German Engineers (V.D.I.). A bibliography of 636 entries is given.

An Index to Chemical and Related Subjects. L. Hilt. New York: American Gas Association, 1947. Pp. 114 + x.

This brings up-to-date to 1945 the previous publication of this character published by the Association. In general it covers all the publications of the A.G.A. not ordinarily indexed or abstracted in the scientific literature.

Journal of the Junior Institution of Engineers. Vol. 58, 1947–48. London: The Institution, 1948. Pp. 360 + viii.

This volume covers the sixty-seventh session of the Institution and includes papers on: "Fuel for industry—coal to oil conversions," by J. Duguid; "Fluid motion in curved pipes," by S. J. Moore; "Design of a liquid fuel atomiser and projector," by E. S. Elliott; "Coal, oil, and chemicals," by J. G. King: "Submersible pumps and motors," by W. L. Gardiner.

Proceedings of the A.S.T.M. Vol. 48, 1948. Philadelphia: The Society, 1949. Pp. 1354 + xii.

This volume includes all reports and papers accepted during the year and any discussion thereon. In addition to the Report of Committee D-2 on Petroleum Products and Lubricants, there are several items of interest to the petroleum industry. These include committee reports on gaseous fuels (D-3), road and paving materials (D-4), bituminous waterproofing and roofing materials (D-8), engine anti-freezes (D-15). A paper of interest is "The detection of corrosive sulphur compounds in mineral transformer oil," F. M. Clark and E. L. Raab.

Technical Publications 1946. New York: Standard Oil Co. (New Jersey), 1947. Pp. 356 + viii.

A selection of twenty-three articles published in 1946 by members of the staff of the Standard Oil Co. (New Jersey) and its affiliates have been selected to form this first volume of a proposed annual series. After an introductory article by E. V. Murphree (president of Standard Oil Development Co.) then follow sixteen articles on various research matters subdivided as process, chemical, engineering, production, physical, and performance. Four articles are included under analytical methods, and there are two on physical data.

Standard Oil Company (New Jersey) and Oil Production in Hungary by Maort, 1931-48. New York: European Gas & Electric Co., 1949, Pp. 45 + xv.

German Intelligence Reports.

B.I.O.S.

1825. German Practice and Operations of Producer Gas Driven Vehicles and Vehicles Operating on Compressed Gas. Pp. 46.
1831. The Wax Industry in Germany. Pp. 315.

F.I.A.T.

952. High Pressure Hydrogenation in Germany. Pp. 247.

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Oilfield Exploration and Exploitation.

Geology.

898. Effect of Uplift and Denudation on Underground Temperatures. A. E. Benfield. *J. appl. Phys.*, 1949, **20** (1), 66–70.—The calculations and computations are based on simple ideal conditions. Effects of speed of denudation, rate of uplift, and the time during which these processes may have been operating are illustrated by numerical examples. It is shown that uplift and denudation increase the heat flow from the earth as a result of the disturbance caused to the underground temp gradient. No very large increase is likely to occur, however, unless the equilibrium heat flow is small and the speed of denudation is large. D. F. J.

899. Compiled Formulæ for Problems in Structural Geology. L. G. Duran. *Oil Gas J.*, 17.2.49, **47** (42), 106.—A series of diagrams and tables gives formulæ for thickness, depth, and dip computations. G. D. H.

900. Discoveries, New Pays in 1948—Their Size and Location. Anon. *Oil Gas J.*, 27.1.49, **47** (39), 276.—A series of tables give by states and districts for U.S.A., the location of new field and pay discoveries in 1948, with the proven acreage, formation thickness, and estimated reserves and the producing formation. G. D. H.

901. Field Name, County, Location, and Initial Production of Discovery Wells. Anon. *Oil Gas J.*, 27.1.49, **47** (39), 238.—The location, producing depth, and sand, and the initial production of 1948 discoveries in U.S.A. are given for pays and field in alphabetical order, grouped under states and districts. G. D. H.

902. Wildcat Success Ratio Stays High Though Number Takes Big Jump. P. de Armond. *Oil Gas J.*, 27.1.49, **47** (39), 176.—6877 wildcats were completed in the U.S.A. in 1948, 1416 more than in 1947. 15% found oil and 3·6% found gas. 2568 wildcats were drilled in Texas, 492 in California, 310 in Louisiana, 831 in Oklahoma, 510 in Kansas, and 622 in Illinois. The Permian basin was in the limelight in Texas. One of the most important finds was at Benedum. Off the coast of Louisiana seven producing areas were opened. Fifty-two new oil pools and thirteen new gas areas were opened in Oklahoma, some of which later merged into old areas.

The 1948 exploratory results in the leading states are summarized in tabular form. G. D. H.

903. Gaps in Gulf Coast Trends Being Filled In. Anon. *Oil Gas J.*, 20.1.49, **47** (38), 119.—In May 1948, 3·2 miles northeast of Sarita, Texas, a well found a flow of 13,500,000 cu. ft. of gas and considerable distillate in a sand at 5894–5909 ft. In October a well 3·5 miles northeast of Sarita obtained a flow of 8,200,000 cu. ft. from 2278–2288 ft. Later the first well was recompleted at 4611–4621 ft for 76 b.d. of 37·4° crude with 19 brl of water and a GOR of 940. Recently 16 miles southwest of Sarita a well has flowed 270 b.d. of 43° oil from 7076–7078 ft after drilling to 11,282 ft,

and recovering oil in a drillstem test at 5975–5982 ft. Sarita is east of the Sam Fordyce–Vanderbilt fault zone. G. D. H.

904. Crossroads Pool in New Mexico Developing Cautiously. Anon. *Oil Gas J.*, 10.2.49, **47** (41), 125.—The Crossroads pool of eastern Lea County was opened in 1948. Two wells produce from the Devonian at about 12,000 ft; other wells are under way. 3 miles north and 1 mile east of the discovery a well is drilling on what appears to be a separate structure. G. D. H.

905. Southeast New Mexico Gets Interesting Simpson Strike. Anon. *Oil Gas J.*, 23.12.48, **47** (34), 97.—Continental *et al* 1–B–29 Warren, NW SE 29–30s–38e, Lea County, New Mexico, has flowed oil in a test of the McKee sand section of the Simpson. The oil came from 8947–9070 ft, and the gas–oil ratio was about 670 cu. ft./brl. 11 miles northwest another McKee sand discovery has been made. G. D. H.

906. Main Divisions of the Pennsylvanian Period and System. R. C. Moore and M. L. Thompson. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 275–302.—A number of divisions of the Pennsylvanian system have been previously designated in North America.

An analysis of physical characters and palæontological features leads to the conclusion that the stratigraphic cleavage at two positions within the system is most significant, and that there are, in fact, grounds for recognizing three major series, which the authors classify as follows: Lower Pennsylvanian deposits or the Ardian series; Middle Pennsylvanian deposits or the Oklan series; and Upper Pennsylvanian rocks or the Kawvian series.

The names chosen for these series are derived from place names and have specified type areas, but the names Ardian and Oklan go a step beyond precedent in using only part of a geographical name.

The Ardian Series includes Springeran and Morrowan rocks, which are classed as stages. The Oklan series is made up of Atokan (or Derryan) and Desmoinesian stages. The Kawvian series contains the Missourian and Virgilian stages. E. N. T.

907. Geology and Occurrence of Natural Gas in Oriskany Sandstone in Pennsylvania and New York. F. H. Finn. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 303–335.—In the sixty-six gas pools of the Appalachian area, the Oriskany sandstone and the Onondaga formation are the principal reservoir horizons. Accumulation has mainly been due to structural conditions, but more than half of the total reserve of gas is in a large field in West Virginia which is productive because of stratigraphical trapping—the interruption in porosity in an updip direction. Total gas reserves in the Oriskany and Onondaga gas pools are estimated at 1½ trillion cu. ft.

In northern Pennsylvania and southern New York thirty-four producing gas pools have been developed since 1930. These pools are structural traps caused by doming and thrust faulting along a series of prominent anticlines. E. N. T.

908. Stratigraphic Accumulation in Jackson–Kanawha Counties Area of West Virginia. A. H. McClain. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 336–345.—The main pool of the Jackson–Kanawha Oriskany gas field in West Virginia extends north from Charleston in a broad tapering belt. The Blue Creek pool is northeast of Charleston in a band 4 miles long and 3 miles wide. The Boone County–Campbells Creek pool is on the Warfield anticline south of Charleston in a belt 12 miles long and 3 miles wide. On January 1, 1948, the total area developed was 193,000 acres, and the total gas produced was 721,482,555 million cu. ft. The 1076 gas wells have produced an average of 670,523 million cu. ft. per well.

It is estimated that the field is now 70–80% depleted and that the ultimate production will be 910,000,000 million cu. ft. E. N. T.

909. Intensive Exploration Programme Mapped for Navy's Alaskan Petroleum Reserve. Anon. *Oil Gas J.*, 20.1.49, **47** (38), 45.—It is now believed northern Alaska has a sedimentary basin beginning south of the Naval Reserve, with a rise near the Arctic coast, and possibly a second basin under the ocean. The Umiat well in the southeast of the concession may be near the axis of the basin because it was still in Upper Cretaceous at 6000 ft. A ridge may run from Point Barrow towards Umiat.

Nineteen wells or core-holes have been drilled, and all but five have had shows of oil; however, only one gave a little production. Two wells are to be drilled south of Point Barrow. An earlier well in this area met basement at 3200 ft and had bleeding cores between 3048 and 3200 ft. 100 miles south of Barrow is the Oumalik anticline, 22 miles long and 7–8 miles wide, with 900 ft of closure. Some shallow holes will be drilled on the eastern side of Cape Simpson. An earlier well in this general area met basement at 7000 ft and had an oil and gas show.

Four seismograph parties are to operate, and six geological parties. G. D. H.

910. Alberta Prospects Increasing by Leaps and Bounds. Anon. *Oil Gas J.*, 3.3.49, **47** (44), 119.—1 Barrhead, LSD 15, 10–58–5w5, may be a 1000-brl Madison well with 24·4° oil and 3 million cu. ft. gas/day at 3992–4117 ft. The Madison was topped at 3980 ft. The well is 60 miles west of Redwater.

1 Bon Accord, LSD 1, 29–56–23w4, 12 miles southwest of Redwater, on drillstem test has given 35° oil from 3585–3613 ft in the D–2 zone of the Devonian. The D-3 zone is to be tested. 1 Schoepp, LSD 9, 22–51–27w4 has found the D–3 zone oil saturated. It may be a new field or a 4-mile west extension of Woodbend. 1 Joseph Lake, LSD 11, 22–50–22w4, 12 miles east of Leduc, recovered oil from an upper Cretaceous sand at 3269–3276 ft. G. D. H.

911. Petroleum and Natural Gas. Anon. *Canad. Min. metall. Bull.*, Sept. 1948, (437), 556–558.—In June 1948 the Alberta production was over 900,000 brl. 180,195 ft of hole was drilled in June. Fifty-eight geophysical and core-drilling crews were operating in Alberta, two in Saskatchewan, and four in Manitoba. Forty-six wells were drilling, twenty-one testing, sixteen standing, and 546 operating in Alberta.

Extensive testing of the Madison is being carried out in the Pincher Creek well. 7 miles northwest Gulf Marr No. 1 was drilled at 6100 ft. 70 miles northwest of Jasper Muskeg No. 1 has reached the top of the Madison.

A table gives the oil production by fields during June. G. D. H.

912. Two Southern Alberta Tests Look Interesting. Anon. *Oil Gas J.*, 16.12.49, **47** (33), 135.—Socony-Vacuum 1 Craigmyle, LSD 12, 32-32-1w4, some 90 miles northeast of Calgary has recovered 34° oil in a drillstem test of the Madison at about 4050 ft 16 miles to the southeast. Hanna Petroleum's 3 Hanna Pete, LSD 14, 5–33-14w4 has obtained 32° oil in a drillstem test of the Sunburst sand at 3704–3714 ft. 1 Dowling had previously found wet gas in the Sunburst. 1 mile east of 3 Hanna Pete Berry Creek Petroleum's No. 1 discovered wet gas in the Madison in 1947.

The Madison thins east and north from the Alberta foothills. The Craigmyle and Hanna wells are probably associated with the Sweetgrass Arch. G. D. H.

913. International Developments. Anon. *Oil Gas J.*, 17.2.49, **47** (42), 77.—Well 18 at Cerro Manantiales, Chile, is a producer with 300 b.d. and a GOR of 1500.

6 miles southwest of the Oued Beth field of French Morocco, oil has been found at about 2000 ft. Oued Beth, opened in 1947, has three wells with an aggregate output of about 300 b.d. G. D. H.

914. Germany Strives for Increased Oil Development to Meet Country's Needs. L. S. Thompson. *Oil Gas J.*, 10.2.49, **47** (41), 45.—The production of about 14,000 b.d. is about a quarter of Germany's internal oil requirements. During the past fifteen years over a thousand exploratory wells have been drilled, but only twenty-three were successful. The Wietze field was opened in 1874, and during the next forty-five years three other fields were found, all fairly close together in the Hannover basin. Except for two minor fields in Baden the present output is restricted to the North German plain. Much of the area is covered by Pleistocene to Recent deposits. The underlying beds range in age from Carboniferous to Tertiary. There are many marked unconformities. During the Carboniferous northwest–southeast and northeast–southwest structural trends were established, and the mountains resulting were deeply denuded to provide materials for the Lower Permian red beds. To the north these terrestrial beds are replaced by marine deposits, and in the Upper Permian the Zechstein was formed with its important salt deposits. There was general uplift in the Rhaetic and further minor movements in the Upper Jurassic forming the Pompecky platform

to the east and north, and the Hannover basin. The former feature subsided in the Upper Cretaceous.

Some 250 salt domes are known, but only eighteen have been thoroughly tested, thereby giving twenty-three out of Germany's thirty-one oilfields. Twenty other salt structures have been partly explored by drilling without marked success. The salt appears to have risen at the intersection of anticlinal trends. The plug diameters range 2–5 miles, but some are long and narrow. Flank production is very erratic. In supercap production structural conditions are usually much simpler, though faulting may still be present. Germany also has some normal anticlinal production as at Steimbke and in Emsland. Oil has been found in formations of Carboniferous to Eocene age, but more than half the production has come from the Wealden and Valendis (Lower Cretaceous). About 10% has come from the Dogger and Malm (Jurassic), and similar amounts from the middle Zechstein dolomite and the Rhaetic. Developments have been chiefly along the Aller river region, which follows an old Hercynian structural line. There are some fields near Hamburg, and a further group occurs near the Dutch border.

The area has been extensively explored by torsion balance, gravimeter, and magnetometer surveys, in addition to regional refraction seismic surveys. G. D. H.

915. New Natural Gas Region in Szalowa-Bieśnik near Gorlice. F. Hempel. *Nafta*, Mar. 1948, **4**, 81–87.—The author in this monograph describes the geological formations in that region supporting his statements and conclusions on drilling lags made in 1935. Several sections and maps are included. All this evidence points to the likelihood of a reservoir holding several milliards (10^9) of m^3 of natural gas. Reference is made to an article by Dr H. Swidzinski, *Nafta*, 1946 (May). M. S.

916. Egypt Sees Big Promise in New Sinai Area Well. Anon. *Oil Gas J.*, 20.1.49, **47** (38), 44.—In two short tests the fifth well in the Asl field of the Sinai peninsula has flowed at the rate of nearly 40,000 b.d. The well was brought in at 3427 ft in Eocene limestone. Asl is about 10 miles south of Sudr. G. D. H.

917. Ore Deposits in the Netherlands East Indies.—J. Westerveld. *Ingenieur*, 25.3.49, (12), Mk. 1–13.—This is the first of a series of articles dealing with the structure, geological history, and ore deposits in the Netherlands East Indies.

The article is illustrated by five maps. A. H. B.

Geophysics and Geochemical Prospecting.

918. Can Geophysical Reflections be Correlated with Geological Horizons? E. J. Handley. *Oil Gas J.*, 3.3.49, **47** (44), 84.—In an area in central Oklahoma it was found that a trough agreed precisely with the top of the Viola limestone, but shallower reflections could not be associated with either the top or the bottom of the Avant–Dewey section. In some parts of north Texas and the San Joaquin basin excellent reflections could not be correlated with known geological markers, but could be tied up with characteristic resistivity peaks in the body of rather thick shale sections. In parts of Mississippi, north Louisiana, and east Texas shallow reflections can be correlated with shallow "chalk" markers, but there was no similar relationship for deep reflections.

After well-velocity surveys some workers put the reflection record along the "time" co-ordinate and the well log or Schlumberger log along the "depth" co-ordinate. In some areas there is good correlation with the S.P. log, in others with the resistivity log. The S.P. log is largely indicative of porosity or density changes, and so may tie up with velocity changes. Velocity data obtained from long profiles or analysis of Δt's are not sufficiently accurate to connect a reflection with a given geological horizon.

G. D. H.

Drilling.

919. Compressibility of Fluids. C. E. Clason. *World Oil*, Nov. 1948, **128** (7), 114.—At the higher pressures obtaining in drilling wells, compressibilities of fluids may be of greater importance than in the past. Additional fluid volumes required due to compression at various depths and conditions are tabulated. C. G. W.

920. Causes and Prevention of Drill Pipe and Tool Joint Trouble. Part 2. H. G. Texter and R. S. Grant. *World Oil*, Nov. 1948, **128** (7), 124.—The effect of scars, notches, wrinkles, etc., on failure is described. Any such marks accelerate fatigue and corrosion fatigue due to stress concentrations at such points. C. G. W.

921. Causes and Prevention of Drill Pipe and Tool Joint Trouble. Part 3. H. G. Texter and R. S. Grant. *World Oil*, Dec. 1948, **128** (8) 100.—This, the third of a series of articles deals with corrosion fatigue in drilling equipment. The most common cause of corrosion fatigue is salt, of fairly low concentration. The effects of corrosion are intensified by the occurrence of fatigue and vice versa. Thus failure occurs much more rapidly than under normal conditions. Preventive measures are the use of internally coated drill pipe and of long drill collar strings, avoiding compressive bending stresses. Hydrogen embrittlement is briefly dealt with. C. G. W.

922. Drilling Rigs for Deep Wells. J. R. Mahan. *Petrol. Eng.*, Feb. 1949, **21** (2), B-34.—The economics of deep-well drilling demand full consideration of the problems involved and careful design of all equipment. Adequate drill pipe, tool joints, casing, lines, and derricks are either in production or in the process of development. Trends in prime movers have for some time been towards diesel motors. Diesel-fuel diesels appear to be the most economical engine for rig surface. Loads encountered and power required are analysed. The trend is ever towards greater pump loads—two-thirds or more of total h.p. requirements are used in mud circulation.

Modifications necessary in the draw-works for deep drilling are detailed. The need for well-designed and adequate controls is emphasized. Large slush pumps are available, and multiple pump operation now being possible, pump capacity is adequate for deep drilling. References are appended. C. G. W.

923. Mechanics of Drill-Stem Testing. Part 1. R. E. Edwards. *World Oil*, Dec. 1948, **128** (8), 83.—The basic principles involved in drill-stem testing are outlined. The methods of operation and the factors to be considered in handling various types of equipment are described. Particular attention is paid to handling under adverse conditions which may occur when testing formations. G. C. W.

924. Relationship of Drilling Mud Resistivity to Mud Filtrate Resistivity. H. W. Patnode. *J. Petrol. Tech.*, Jan. 1949, **1** (1), 14–16. (*A.I.M.M.E. Tech. Paper No.* 2512.)—Experiments have shown that for suspensions of fine particles of high resistivity the ratio of the resistivity of the suspending medium to the resistivity of the suspension is proportional to the mth power of the fraction of fluid present, m being a constant. A slurry of clay such as Aquagel may have a higher or lower resistivity than the filtrate. The resistivity of a drilling-mud filtrate is usually appreciably less than the resistivity of the mud, but may be the same or greater. The ratio of filtrate resistivity to mud resistivity has been found to range from 1·5 to 0·66.

In making quantitative calculations from electric-log data it is incorrect therefore to assume that the mud filtrate resistivity is the same as the mud resistivity. Consequently both resistivities must be measured. G. D. H.

925. Rotary Percussion Drilling. W. E. Harpst and E. E. Davis. *Oil Gas J.*, 17.3.49, **47** (46), 182.—A tool has been developed which in addition to normal mud circulation, bit preloading, and rotary drilling action allows a percussive impact on the bit.

The impact is provided by a hammer under fluid pressure. With the hammer in its lowest position, fluid pressure is dissipated through a fluid passage, and a control spring returns the hammer to its normal position. The cycle is then repeated.

The development of suitable bits for the tool and construction and operation of the tool are described. C. G. W.

926. A Quantitative Analysis of the Electrochemical Component of the S.P. Curve. R. J. Wyllie. *J. Petrol. Tech.*, Jan. 1949, **1** (1), 17–26. (*A.I.M.M.E. Tech. Paper No.* 2511).—In the course of a study of the e.m.f. across a shale barrier in relation to the concentration of sodium-chloride solutions on the two sides it became apparent that the shale barrier is analogous to a glass membrane separating two acid solutions with different hydrogen-ion concentrations. The shale acts as a sodium electrode and

responds to the activities of the sodium ions in the two solutions so that, as confirmed experimentally, the potential can be calculated by means of the Nernst equation. In a borehole the total e.m.f. of a shale cell is the algebraic sum of the potential across the shale and a boundary potential. Predicted total e.m.f.'s for various resistivity ratios of the two sodium chloride solutions and different temperatures were found to agree well with the self-potential read from electric logs.

A method is proposed for calculating the connate water content of a porous formation with both connate water and hydrocarbons, from the S.P. and resistivity curves of the electric log. G. D. H.

927. Sidewall Sampling. Tools and Technique. Part 1. J. E. Kastrop. *World Oil*, Nov. 1948, **128** (7), 100.—With the advent of the electric log, sidewall sampling became an important operation in drilling. The costs of conventional coring are eliminated, since samples need only be taken at points indicated by the electric log. The method may also be used to check sections where conventional coring has failed and it is important to know the formation. Types of sidewall samples are the Punch, percussion, and rotary types. The development and operation of these tools is described. C. G. W.

928. Sidewall Sampling. Tools and Technique. Part 2. J. E. Kastrop. *World Oil*, Dec. 1948, **128** (8), 76.—A description of percussion and rotary sidewall sampling tools concludes these two articles. It is emphasized that sidewall coring is complementary to conventional coring and is not intended to replace it.

References are appended. C. G. W.

929. Use of Permeability Distribution in Water-flood Calculations. W. E. Stiles. *J. Petrol. Tech.*, Jan. 1949, **1** (1), 9–13. (*A.I.M.M.E. Tech. Paper No.* 2513.)—The permeability variations in a reservoir can be represented by a permeability-distribution curve, and from this the capacity distribution can be derived by summation. Equations have been derived which permit the oil- and water-production rates to be calculated from the capacities, and from these the water cut at different stages in the flood can be obtained. A sample performance curve is calculated, and curves showing predicted and actual performance are included.

The technique cannot be applied where a gas zone overlies or a water zone underlies the oil section in the area of the flood. The results apply to the area as a whole and not to single wells, and do not allow for structural features, etc. G. D. H.

930. We are Oil-Minded. M. Taranger. *Bull. Ass. franç. Tech. Pétrol.*, 1949, (74), 3–15.—A plea for more intensive drilling in France. The necessity for a team spirit and the right attitude of mind in drilling crews is stressed, and it is considered that a greater footage drilled is reflected in a proportionately greater subsequent production of oil. V. B.

Production.

931. Compressibility Factors in the Estimation of Gas Reserves. E. B. Elfrink, C. R. Sandberg, and T. A. Pollard. *Oil Gas J.*, 3.3.49, **47** (44), 89.—Use of compressibility factors in estimating reserves is illustrated. References are appended. C. G. W.

932. Condensate Reservoirs. M. Muskat. *Oil Gas J.*, 24.2.49, **47** (43), 146.—A short summary of the characteristics of condensate reservoirs. References are appended. C. G. W.

933. Counterbalancing and Peak Load Determination. K. N. Mills. *World Oil*, Nov. 1948, **128** (7), 176.—Counterbalance absorbs energy during the phase and releases it during another phase. Hence it reduces the peak power demand and results in reduced wear and costs.

Types of counterbalance used are beam rotary and pneumatic. Degree of counterbalance required can be deduced having accurate dynamometer data. In the case of electric-motor drives a recording ammeter may be used, and with engine drives a recording techometer is adequate. In these cases the peak power demands and the crankshaft speeds respectively should be equal on the up and the down strokes.

Equations for calculating the effective counterbalance force from dynamometer data are given. References are appended. C. G. W.

934. Deep Oil Well Pumping. K. N. Mills. *World Oil*, Dec. 1948, **128** (8), 137.—For a given max working load for sucker rods there is a max pumping depth. This depth can then be increased only by improved operating practices. Any reduction in load will lead to increased possible pumping depth. The factors involved in the load on sucker rods are weight of fluid column, weight of rods, and the force to accelerate the moving mass.

An equation for well load based on these factors is given by the author.

$$PL = W_0 + W_R\left(1 + \frac{LN^2}{70{,}500}\right)$$

where

PL = polished rod load
W_0 = weight of fluid column
W_R = weight of rods in air
L = length of surface stroke
N = number of strokes per minute.

The effect of longitudinal vibration of the rods on well load is discussed. For maximum production there is an optimum plunger area, and equations for calculating this are given. The effects of corrosion and fatigue on the life of rods are discussed. References are appended. C. G. W.

935. Ring Dynamometer for Pumping Wells. D. O. Johnson. *World Oil*, **128** (7), 161.—Adequate well studies are rarely made owing to lack of personnel, lack of instruments, and excessive time required. To minimize these disadvantages the ring dynamometer has been developed. The dynamometer is a ring of alloy steel, forces are applied along a diameter and the deflection measured by a micrometer. The construction and operation of the dynamometer is described. C. G. W.

936. Gas Drive Performance. M. Muskat. *Oil Gas J.*, 3.3.49, **47** (44), 80.—A summary of performance in gas-drive reservoirs. References are appended. C. G. W.

937. Hydraulic Process for Increasing the Productivity of Wells. J. B. Clark. *J. Petrol. Tech.*, Jan. 1949, **1** (1), 1–8. (*A.I.M.M.E. Tech. Paper No.* 2510.)—In the "Hydrafrac" process the producing formation is fractured hydraulically in order to increase its permeability. To achieve this a viscous liquid is injected into the formation at such a pressure as will cause formation parting. The liquid contains a granular material to act as a prop in the partings. By virtue of its properties or by the introduction of a second fluid the original liquid decreases in viscosity and can then readily be displaced from the formation. A suitable liquid is the Napalm-gasoline gel to which ½–1% of water has been added. This reverts from gel to sol in 8–24 hr, while the change can be made much more rapid by introducing a dilute solution of petroleum sulphonates.

To date twenty-three wells in seven fields have been treated by this process, and in eleven cases there has been a sustained increase in production. Both gas and oil wells have been treated. In the oilfields two cases were noted in which non-producing wells became producers; in other instances the output rose by amounts up to 167% of the original value. There were cases where in spite of formation breakdown there was no rise in output.

Curves show the pressure during the treating process and the producing rate before and after treatment. A table summarizes the results of treating the various wells, and a diagram shows permeability profiles before and after "Hydrafrac" treatment.
G. D. H.

938. Mariette and Water-Flooding. W. Kulczycki. *Nafta*, Mar. 1948, **4**, 92–96. (Lecture given to Assn of Petroleum Engineers and Technologists.)—Repressurizing in Poland is still quite rare, and the lecture deals with its history and scientific basis (cf. "Analytical Basis of one of the problems of Subsurface Fluid Flow," W. Kulczycki. *Nafta*, Feb. 48, **4**, 48–52). Water acts as a piston on the crude, but it cannot be

applied too fast. Experiments of Wyckoff and Botsett are quoted to prove that better results are obtained by using water than with gas, but gases are always present with crude; therefore triangular diagram of Leverett and Louis must be used.

The limitations of mariette and of water-flooding depend on their wetting properties compared with those of crude. These determine the shape of the "minimum crude saturation" curve. It is found to be best to use the medium (water or gas) which is present with crude in relatively lowest proportion.

Professor Maksymowicz is quoted as stressing the importance of porosity, permeability, saturation, pressures, solubility, and viscosities of fluids before decision is made to use one or other method. M. S.

939. Measuring Oil-Pool Performances. C. Beal. *Oil Gas J.*, 10.3.49, **47** (45), 74.—An index of pool performance is introduced.

$$Y = \frac{1000R}{V(\Delta P)}$$

Y = performance index brl per p.s.i. per acre ft.
R = Cumulative oil production to date brl.
V = reservoir bulk volume acre-ft.
ΔP = average reservoir pressure drop p.s.i.

Available reservoir data is summarized and tabulated. It is shown by example that it is possible to predict approximately: (1) reservoir control early in the life of the reservoir; (2) ultimate oil recovery; (3) original reservoir volume in depletion-type reservoirs; (4) volume of oil movement between wells on a leasehold and an oil pool produced under depletion control. C. G. W.

940. Mechanical Controls for High Pressure Wells. J. Ward. *World Oil*, Nov. 1948, **128** (7), 169.—Mechanical controls, particularly those adaptable to remote or automatic control, are very valuable in remote and hazardous areas. Several such controls, *e.g.*, subsurface chokes, regulators and tubing safety valves, and surface flow-line shut-off valves are described. C. G. W.

941. Oil Production by Gas and Flooding. Part 1. P. J. Jones. *World Oil*, Nov. 1948, **128** (7), 194.—This is the first of a series of articles dealing with separation and extraction problems encountered in production by gas infection or water flooding. In this article the application of K values—equilibrium constants of components—to oil and gas separation are illustrated. Published data on K values is correlated and tabulated. C. G. W.

942. Oil Production by Gas and Flooding. Part 2. P. J. Jones. *World Oil*, Dec. 1948, **128** (8), 170.—A procedure for determining composition and volume factors in high-pressure reservoirs is given. References are appended. C. G. W.

943. Approximate Determination of Production Behaviour. A. Houpeurt. *Rev. Inst. franç Pétrole*, Sept. 1948, **3** (9), 231–244.—An approximate method is described whereby the production behaviour of a gas field may be determined, and it is reported that the technique is of general applicability and can be applied to oilfields. If the wells are drilled on a fixed pattern, either square or triangular, an area of a standard form can be associated with each well. A circle can be drawn around each well and touching the sides of the unit area, and it can be assumed that the isobars are right-cylindrical surfaces centred on the wells, provided that the formations are uniform and flat. Where the circles touch marks the limits of the drainage areas.

The mechanism of production can be considered as having two stages. The opening of the well disturbs the pressure equilibrium, and an expanding circle marking the limits of pressure disturbance moves outwards from the well until the limit of the drainage area is reached. The time during which this phenomenon is going on is known as the period of propagation. Subsequently the entire area thus swept is subjected to a decline in pressure and the period of decompression begins. Equations are developed which take account of these two stages in the production history. Curves are presented which show the predicted relationships between pressure and time, production and time, productivity index and time, etc. G. D. H.

944. Relative Permeability. M. Muskat. *Oil Gas J.*, 17.2.49, **47** (42), 121.—This is a summary of a lecture on relative permeability. References are appended. C. G. W.

945. Shot-Hole Treatment for Clogged Drainage. F. R. Cozzens. *World Oil*, Nov. 1948, **128** (7), 190.—If clean-out work is delayed, sand-face deposits tend to work back into fracture channels. Broken fragments of such residue seem to migrate along channels and plug the drainage system. Such plugs are unaffected by sand-face treatment, and reconditioning is thus rendered ineffective. Sand-face treatment is effected by washing the hole with brine and then filling with paraffin solvent. The solvent should be heated, maintained hot for from 36 to 48 hr, and bailed out while hot. The well is left open for 10–12 hr. When the hole fills with oil, sludge is bailed off and pumping resumed within about three days.

Such a clean out may be followed by nitroglycerin or compressed-air treatment. C. G. W.

946. Tubing Leak Tests. R. Sneddon. *Petrol. Engr*, Feb. 1949, **21** (2), B-62.—Tubing leaks may have a considerable effect on lifting costs and on oilfields. Leaks may be due to corrosion abrasion, splits, or pinholes. Tubing leaks may be detected by a hydraulic tester when the well is being pulled. The top of each stand is plugged as the string is broken and the stand coupled to the tester and raised to the test pressure. Visual inspection exposes the leaks. Results of tests indicating the prevalence of tubing leaks are tabulated. C. G. W.

947. Tubing Stretch and Pump Efficiency. K. N. Mills. *Petrol. Engr*, Feb. 1949, **21** (2), B-54.—The alternate loading and unloading of the tubing during the pumping cycle causes stretching and contraction of the tubing. This tubing stretch reduces the effective plunger stroke and hence the pumping efficiency. A type of tubing anchor, to eliminate stretch, is described. C. G. W.

948. Tubing Tool Joints. L. S. McCaslin. *Oil Gas J.*, 24.2.49, **47** (43), 143.—Use of tool joints in place of the conventional couplings on tubing protects tubing from wear and tear and shortens round trip time. C. G. W.

949. Tabulated Summary of Oil Searches in France and the French Union. Anon. *Rev Inst. franç. Pétrole*, 1949, **4**, 36–39.—Data are given regarding development and wildcat wells completed during the second half of 1948, with forecasts for the first half of 1949. A brief summary of producing French fields, giving daily production as at January 1, 1949, is included. (Cf. Abstract No. 770.) V. B.

950. Well Histories in Water Flooding. M. Muskat. *Oil Gas J.*, 10.3.49, **47** (45), 105.—A short summary of a lecture on this subject. References are appended. C. G. W.

951. Workover Operations and Equipment Replacement. N. Ferrill. *Oil Gas J.*, 17.2.49, **47** (42), 109.—Economic factors involved in workover operations are evaluated. C. G. W.

Oilfield Development.

952. World Production Rose 12·7% in 1948. Anon. *World Petrol.*, 1949, **20** (1), 48.—The average world daily production of oil was 9,363,600 brl in 1948, and at the end of the year the rate exceeded 9,800,000 b.d. 77·8% of the 1948 output came from the western hemisphere, and North America averaged 5,705,200 b.d., the U.S.A. giving 5,512,700 b.d. Middle East fields averaged 1,180,900 b.d., of which 130,000 b.d. was from Kuwait and 390,000 b.d. from Saudi Arabia. Iran averaged 525,000 b.d. The Netherlands East Indies had an output of 84,400 b.d. and British Borneo 54,500 b.d.

Tables give the daily rates by countries for 1939, 1946, 1947, and 1948, and the proportions of the world output attributable to the leading countries in each of the last three years. G. D. H.

953. Annual, Cumulative Production, Remaining Reserves by Fields. Anon. *Oil Gas J.*, 27.1.49, **47** (39), 284.—A series of tables gives—by states and districts for

the larger fields of the U.S.A.—the 1948 production, the cumulative production, estimated reserves, and the number of wells at the beginning of 1949. G. D. H.

954. Crude Production Tops 2 Billion Barrels for First Time in 1948. P. de Armond. *Oil Gas J.*, 27.1.49, **47** (39), 184.—The leading producing states in the U.S.A. in 1948 were Texas (923,227,000 brl), California (345,333,000 brl), Louisiana (189,972,000 brl), Oklahoma (154,680,000 brl), and Kansas (108,017,000 brl). The total U.S. output was 2,051,433,000 brl.

Tables give by states the outputs in the years 1942 to 1948 and the cumulative outputs, the peak production and year for each state, and the daily average output per well for each state in 1948. The U.S. average was 13·8 b.d. G. D. H.

955. Exploratory and Development Drilling: Where it Occurred and the Results. Anon. *Oil Gas J.*, 27.1.49, **47** (39), 296.—A series of tables give by states and districts for the U.S.A. the types of wildcat and development completions and the footage monthly for 1948; the types of wildcat and development completions, and footage by fields in 1948. G. D. H.

956. Nearly 40,000 Wells Completed Despite Material Shortage. J. C. Casper. *Oil Gas J.*, 27.1.49, **47** (39), 172.—39,778 wells with a footage of 137,392,000 ft were completed in the U.S.A. in 1948. 1947 completions totalled 6656. There were 22,585 oil wells and 2897 gas wells completed in 1948; the corresponding figures for 1947 were 17,999 oil wells and 3303 gas wells. 6877 wildcats were completed in 1948; 15% were successful.

Tables give the completions according to type, and the footage by states and districts for 1948; the numbers of service wells and distillate wells completed each month in various areas; the wildcat completions according to type by states and districts, with a similar breakdown for development wells; the numbers of wells completed in each area by cable or rotary drilling; the number of wells of each type completed each month; and the footage drilled in each state and district yearly from 1941.

G. D. H.

957. New World's Record Producing Depth Established in 1948. P. de Armond. *Oil Gas J.*, 27.1.49, **47** (39), 178.—In Natrona county, Wyoming, a wildcat recovered oil from the record depth of 14,307 ft; in Iberia Parish, Louisiana, a well is producing from 14,232 to 14,255 ft. The deepest well drilled was 17,832 ft, in Caddo county, Oklahoma.

Tables give the deepest well drilled and the deepest production obtained in each of the various states and districts of the U.S.A. G. D. H.

958. Proven Reserves Increase Despite Record-bearing Withdrawals. C. J. Deegan. *Oil Gas J.*, 27.1.49, **47** (39), 187.—At the beginning of 1948, U.S.A. reserve of crude oil, condensate, and other natural-gas liquids were estimated to be 27,325 million brl, and the dry natural-gas reserves 175,187,000 million cu. ft. Crude-oil and condensate reserves are placed at 24,834 million brl. The leading states for liquid-hydrocarbon reserves are Texas (15,594 million brl), California (3676 million brl), Louisiana (2255 million brl), and Oklahoma (1085 million brl). The same states lead in natural-gas reserves.

Tables set out by states, and in some cases by districts within states, give the following data: reserves of crude oil plus condensate at the beginning of 1948 and 1949, and other natural-gas liquids at those dates; the crude-oil and condensate reserves at the beginning of 1948, the addition through discoveries, and by extensions and revisions in 1948, the 1948 production, and the reserves at the beginning of 1949; the natural-gas reserves at the beginning of 1948 and 1949; and the ratio of crude plus condensate reserves to production for the years 1947, 1948, and 1949. G. D. H.

959. 37,550 Wells, 137,500,000 Feet, Predicted for 1949 Drilling. C. J. Deegan. *Oil Gas J.*, 27.1.49, **47** (39), 170.—The U.S. 1949 drilling programme comprises 37,550 wells, 2228 fewer than in 1948, although the aggregate 1949 footage of 137,500,000 ft is 140,000 ft greater than for 1948. 7053 wildcats are planned for 1949; there were 6877 in 1948.

Tables summarize the 1949 drilling programme by states and districts and give the changes from 1948. G. D. H.

960. 60% of Oil Found to Date is Under 130 Major Fields. C. J. Deegan. *Oil Gas J.*, 27.1.49, **47** (39), 180.—The number of oilfields found in the U.S.A. is variously estimated between 5000 and 15,000, but 130 of these have given 60% of all the oil produced in the U.S.A., and they have a little over 60% of the proven reserves. Although one in six wildcats may be successful, only one in 300–600 finds a really big oil accumulation.

Tables give the number of major fields in the various states, the expected ultimate production of these fields, the ultimate production of all the fields in these states, a comparison of the outputs of the major fields and of all the fields in each of these states; a list of the major fields with the discovery year, estimated ultimate, remaining reserves, 1947 and 1948 outputs, and the producing horizon. G. D. H.

961. Drilling Activity at All-Time High during Past Year. R. H. Carlson. *Oil Gas J.*, 27.1.49, **47** (39), 198.—At one period in November 1948, 2457 rigs were operating in the U.S.A. and Canada, over half the number being in the Permian Basin and on the Gulf Coast. In 1948, 499 rigs were operating in countries outside the U.S.A., Canada, and the Russian-dominated areas. About 300 of these rigs were in South America. In Russian-dominated areas 600 rigs are estimated to be operating.

A table gives the numbers of rigs operating in the various countries at the end of 1948, while diagrams show the distribution of rigs in the main areas in 1946, 1947, and 1948, and the numbers operating monthly in the U.S.A. and Canada during the same three years. G. D. H.

962. November Foreign Crude Output is 8% over 1948 Average. Anon. *Oil Gas J.*, 20.1.49, **47** (38), 44.—Outside the U.S.A. the daily oil output in November 1948 is estimated to have been about 3,350,000 b.d. (excluding Russian-controlled areas). The Middle East gave 1,314,000 b.d., and Venezuela 1,354,000 b.d. A table gives the November daily output by countries. G. D. H.

963. Production in Foreign Fields Rose to 3½ Million Barrels in 1948. D. M. Duff. *Oil Gas J.*, 27.1.49, **47** (39), 235.—It is estimated that oil production outside the U.S.A. averaged 3,775,100 b.d. in 1948. The Persian Gulf area is estimated to have reserves of 32,000 million brl, and the Burghan field of Kuwait is ranked as the world's largest oil reservoir with 11,000 million brl.

Venezuela's output rose nearly 12% in 1948 to reach 1,330,000 b.d. Canada's output in 1948 averaged 30,500 b.d. and was 50% above the 1947 level. The Netherlands' output was 9500 b.d. and Germany's output 11,500 b.d. The Netherlands East Indies output rose from 22,000 b.d. in 1947 to 84,400 b.d. in 1948, and British Borneo is estimated to have averaged 54,500 b.d. in 1948. New Guinea became a producer in 1948 with 4000 b.d.

A table gives by countries the production in 1928, 1938, 1947, and the estimated output for 1948. G. D. H.

964. Salt Domes are Source for Almost Entire German Oil Production. L. S. Thompson. *Oil Gas J.*, 17.2.49, **47** (42), 78.—78,750,000 brl of Germany's cumulative output to date of 84 million brl has come from twenty-four salt-dome fields. Thirteen of these are minor fields.

The Steimbke field of the Hannover basin is a simple anticline. The reserves are 2 million brl, and the output in 1946–48 was 860 b.d.

The Emsland area has four oilfields and a major gas field. In three fields oil comes from the Valendis. Georgsdorf and Emlickheim have very porous and permeable sands. At Adorf the Wealden produces. The Bentheim gas field produces from the Platten dolomite of the Zechstein. None of these fields is yet fully outlined.

From 1934 to 1946 over 1000 wildcats were drilled, seventy-eight being government-subsidized. Only twenty-three were successful, although all the wildcats were based on the best geological and geophysical data available. Of twenty-eight wildcats in 1947 one at Eilte gave a small oil output. 1400 development wells were drilled in the 1934–46 period. In 1947 eighty-six development wells were drilled, sixty-three being producers,

At present Germany gives about 14,000 b.d. from 1636 wells, of which 118 flow. The general oil-gravity range is 19–36° A.P.I. The output of the existing wells is expected to be halved in five years.

Drilling costs may be $13–20 per ft for shallow wells (allowing $1 = 3 marks). Production costs may be $4·5–5·75 per brl.

Germany has twenty-four refineries operating, with a capacity of 64,000 b.d. Reserves in sight are estimated at 58 million brl, and probable reserves are placed at 28 million brl. Further discoveries may add a further 80–100 million brl.

Tables give the discovery dates of the fields, their cumulative outputs, 1948 daily outputs, reserves in sight and probable. G. D. H.

Transport and Storage.

965. Reinforced Concrete Storage for Hydrocarbons. Anon. *Bull. Ass. franç. Tech. Pétrol.*, 1949, (74), 44–53.—A summary of an A.F.T.P. meeting on this subject. Data are given showing the comparative permeability of concrete to water and gasoline. Requirements of concrete reservoirs intended for oil storage are outlined, and it is pointed out that the total power consumption involved in the building of concrete storage is somewhat less than for an equivalent capacity of steel storage. A concrete reservoir 20 cm thick reduces heat losses by 60%. The principal points for and against concrete reservoirs are briefly stated. At 1946 prices steel storage is about 30% cheaper, but it is nevertheless considered that the possibilities of storage in concrete should not be overlooked. Twenty-one references. V. B.

966. Materials Handling (Review). R. E. Wright. *Industr. Engng Chem.*, 1949, **41** (1), 59–61.—Pumping, compressing, and conveying technique are briefly reviewed. R. G. T.

967. Mechanical Aspects of Pipeline Coatings. L. F. Sherer and O. C. Mudd. *Oil Gas J.*, 31.3.49, **47** (48), 119.—The characteristics of good coating material are given; and various types of coatings evaluated, based on results of A.P.I. programme of coating tests discussed. Recent developments in coating techniques are outlined.

A single flood-coat of coal-tar enamel, machine applied, gave best results with respect to cost when supplemented with cathodic protection. Cathodic protection should be applied as soon as possible after line is back-filled.

Reinforcing to retard cold flow in bitumen coatings must not absorb or conduct moisture; glass-fibre matting is most practicable, a 12-in pipe or less requires a mat of 15 mm thickness.

Severe abrasion and shock can be withstood by mounting short sections on dollies, rotating them, and applying three successive layers of hot enamel with glass-fibre mat pulled in.

Suitable preparation of the trench is essential, including cushioning the pipe.

For 20–22 in dia pipes a 25-mm glass-fibre mat is recommended, not as a single-flood coat, but by first applying a flood coat, then a reinforcing of glass fibre, then a second flood coat, and finally a wrapper of 15-lb asbestos feet. Average thickness of the complete coat is $\frac{1}{4}$ in.

The pipe should be as clean as possible before coating: loose soil, corrosion products or scale, and adhering moisture must be removed.

The effectiveness of coatings underground may be checked by using Pearson holiday detector. G. A. C.

968. Pitot Tube for High Pressure Pipe Lines. F. E. Culvern. *World Oil*, Nov. 1948, **128** (7), 211.—To determine flow rates at a number of locations on a pipe, it was decided to adapt Pitot tubes, since orifice meters were impracticable. It was required to design a Pitot tube to withstand up to 900 p.s.i. which could be traversed freely across the pipe dia. The tube is introduced through a packing gland by means of two screw jacks. Details of construction and installation are given. C. G. W.

969. Contemporary Views on the Reception of Petroleum Products in Seaports. M. Couteaud. *Bull. Ass. franç. Tech. Pétrol.*, 1949, (74), 18–40.—After discussing tanker

transport and freight rates the general lay-out and operation of an oil terminal is described, with particular reference to the facilities available and planned at Marseilles. V. B.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

970. Fluid Dynamics (Review). D. F. Boucher. *Industr. Engng Chem.*, 1949, **41** (1), 44–51.—A general survey of fundamental aspects of fluid dynamics is followed by an account of general applications. The fluidized-solids technique is mentioned, and special apparatus is discussed with regard to fluid-flow problems. The bibliography is extensive. R. G. T.

971. Heat Transfer (Review). G. T. Skaperdas. *Industr. Engng Chem.*, 1949, **41** (1), 52–55.—This review briefly discusses recent developments in boiling, condensation, convection, and conduction. R. G. T.

972. Tabular Determination of the Overall Coefficient of Heat Transfer for Pipes and Tubes. B. F. Raber and F. W. Hutchinson. *Heating Ventilating Engr*, March 1949, **46** (3), 73.—A table is given by which the total resistance for heat transfer (from one fluid to another) through a pipe or tube wall of negligible resistance can be determined. The table can be applied to either thick- or thin-walled tubes providing the thermal resistance of the wall is small compared with the film resistances, which is generally the case. Equations are quoted which reveal how the basic heat-transfer equation can be modified to take into account: (i) thin-walled tubes of any diameter, (ii) thick-walled tubes when the wall resistance is negligible compared with film resistances. A further equation is given to deal with thick-walled tubes when the wall resistance is appreciable. A. S.

973. Construction Materials for Jet Pumps. M. Richelson. *Chem. Engng*, 1948, **55** (9), 114–117, 248–252.—Qualities required for jet pumps are heat resistance, resistance to thermal shock, and resistance to erosion. A survey of materials has been made with regard to corrosion resistance, machinability, and maintenance of replacement parts. Assessments of various materials with reference to these factors is tabulated extensively. Factors are listed for each category of jet type. R. G. T.

974. Application and Design of Mixing Equipment. H. E. Serner. *Chem. Engng*, 1948, **55** (8), 118–121.—This paper provides correlated data on mixing processes which may be readily applied to the design of equipment. A general classification of methods is followed by a description of the application of special cases. An account of the relative merits, conditions necessary for use, capacity, and theoretical considerations is given in the case of the paddle mixer, turbine mixer, and propeller. The disc agitator is briefly discussed. Graphs are shown of power factors, viscosity factors, and pitch-velocity corrections for use in calc power requirements. R. G. T.

975. Refiners Spending Millions in Plant Expansion Modification. New Processes Assure Greater Efficiencies, Higher Yields. G. Egloff. *Oil Gas J.*, 24.3.49, **47** (47), 153.—This review of the present status of the petroleum industry demonstrates the broad vision, both in the past and the present, which has actuated its administrators and has placed the industry so high in the scale of modern commercial progress. During the past year over $2.5 billion has been spent on expansion and research in the U.S.A. alone, to increase quantity and quality of products, about one quarter of it being allocated to refining facilities. Through this foresight: (1) new processes that provide high efficiencies and improved products have contributed greatly to crude-oil conservation, and (2) modern equipment for both large and small throughputs has eventuated. These modern plants afford great flexibility of operation, owing to their design, high instrumentation, and safety equipment. From 1941 to 1949 production of distillate fuel oils rose 101%, compared with 33% for gasolines, and an overall rise of 44% for all products. It is predicted that by 1953 the U.S.A. railroads alone will be using 200,000 b.d. diesel fuels. Catalytic cracking affords more intermediate

distillates and less residual fuel oils—formerly fuel oils were the only products in excess of demands. Cat cracking and allied processes are discussed, and yield data are given which show how they tie-in to provide superior-quality products.

Research and motor-method O.N.s of gasolines are discussed for the years 1946–48. The trend towards higher compression ratios is discussed, and aviation gasoline demands are noted. Trends in lubricating-oil demands and production are surveyed. During the period 1939–48 production of lubricants rose from 35 million brl to over 50 million brl. The installation of centrifugal compressors for refrigeration in solvent dewaxing has doubled one company's output of premium motor oils.

The petrochemical aspects of the industry are surveyed. Over 3 billion lb of raw material per annum, largely from cracked gases and natural gas, have been supplied for such purposes, about three quarters of the methyl and ethyl alcohols marketed have been made therefrom. The annual production of detergents manufactured from such gases is estimated at 400 million lb. The production of *iso*-octyl alcohol from a cracked gasoline fraction, carbon monoxide, and hydrogen is reported. Increasing amounts of ammonia for fertilizers are being made from natural gas and air. The synthesis of glycerol from propylene and the manufacture of solid CO_2, "dry ice," from oilwell gases are commercial operations. Research facilities and personnel, and testing methods, etc., are discussed. W. H. C.

976. Accurate Pressure Measurement. L. Le Blan. *Chim. et Ind.*, 1949, **61**, 235–239, 349–354.—Accuracy of pressure measurement varies from 10^{-2} (industrial accuracy) to 10^{-5} (max accuracy). The instruments discussed are those with an accuracy $\leqslant 10^{-3}$. Metallic pressure gauges are not normally reliable to a greater accuracy than 10^{-2}. Reference gauges of the mercury and piston type are described, and diagrams given showing their operation. A pressure balance measuring up to 150 kg/cm^2 with an accuracy of $\leqslant 10^{-4}$ has been developed for use in the oil industry. A description, with electric circuit diagram, is also given of a recording pressure gauge for measuring natural-gas pressures (120–200 kg/cm^2) with an accuracy of 10^{-4}. The piezo-electric effect shown by quartz is not suitable for application to accurate pressure measurement; such instruments, whilst particularly applicable for the measurement of rapidly changing pressures, are restricted to an accuracy barely attaining 10^{-2}. V. B.

977. Do You Know Enough about Steam Jet Refrigeration? H. R. Havemeyer. *Chem. Engng*, 1948, **55** (9), 102–106.—Steam-jet water-vapour refrigeration is simple and safe method of refrigerating at temps above f.p. of water. Part of water supply is evaporated under vacuum and thereby cools the remainder of the supply. Vacuum is maintained by steam-jet ejectors and condensers. Advantages are no moving parts, ease of control and operation, safety, low costs. Various uses include flash-cooling, rubber rolls and mixers, gas absorption, distillation, air conditioning. Various special applications are described. Operation, design, and regulation methods are discussed, and economic selection factors reviewed. R. G. T.

978. Power Savings in Process Refrigeration. F. Carr. *Industr. Engng Chem.*, 1949, **41** (4), 776–780.—Classification of refrigeration systems is made into two main classes—space refrigeration, involving transference of heat from constant low temp to const high temp, and process refrigeration, in which heat is removed at a varying temp. Analysis of the performance of different refrigeration cycles suggests the use of a variation of vapour-compression cycle on which calc data are presented. Various practical considerations are included. R. G. T.

979. Shell Ups Capacities of Three Plants; Further Expansion Now Under Way. Anon. *Oil Gas J.*, 24.3.49, **47** (47), 173.—Three of the five refinery-expansion projects of the Shell Oil Co. Inc., have been completed and provide an increase in daily capacity of more than 17% over the 1947 amounts. The 1949 figures in b.d. are: Martinez, Calif. 45,000; Wilmington, Calif., 52,000; Wood River, Ill., 115,000; Norco, La., 38,000; Deer Park (Houston area), 110,000. Some details are given of the extensions and types of operating plants. At Martinez, new equipment for asphalt production and new pilot-plant and research facilities have been added. At Wilmington, in

addition to the same schedule as for Martinez, a new solutizer unit for gasoline sweetening, expanded storage for L.P. gases, and additional gas-compression capacity for cat-cracking plant have been added, and the old Trumble-type units are to be replaced by modern and more efficient equipment.

The Norco refinery has a new pressure-distillate fractionator which with its auxiliaries is described. It increases refining capacity by 6000 b.d. Improvements made and under construction at Wood River are outlined. They include a new 5000 kW turbine generator which increases electric-power capacity to 20,000 kW, a new boiler was installed in 1948 to supply 650-p.s.i., 750° steam, a new tank farm which has remote-controlled electrically operated valves is now under construction. Operations at the Houston refinery now include that of the $20 million lubricating-oil plant with a capacity of 2800 b.d. Fractionation of topping-plant residue by vacuum distillation into appropriate lube oil cuts is the first of five processes, followed, as necessary, by propane-de-asphalting, phenol-extraction, dewaxing, and contact filtration. A 1948 M.E.K. plant also serves in the manufacture of microcrystalline heavy 250 and 100 waxes. The operations and products are each briefly described, and some other improvements in equipment and products are discussed. W. H. C.

Distillation.

980. Distillation Columns with no Side-stream Charged with Feed containing Similar Key Components. V. Chibaeff. *Rev. Inst. franç. Pétrole*, 1949, **4**, 43–47. (Cf. Abstract 1184, 1947.)—A simplified method is presented for calculating the number of plates. The method is only applicable when the ratio of the volatilities of the key components is close to unity, and is based on the graphical determination of the min reflux ratio. The characteristics of the key components suffice to determine the min reflux ratio and the number of plates corresponding to a given reflux ratio. The method is explained, and an illustrative example given. V. B.

981. High Temperature Distillation (Review). T. J. Walsh. *Industr. Engng Chem.*, 1949, **41** (1), 25–27.—A report on industrial distillation is followed by a theoretical review of distillation and distillation calculations. Laboratory apparatus is mentioned, and references to equilibria data are included. R. G. T.

982. Polyform Distillate (Physical Properties and Characteristics). W. C. Offutt, M. C. Fogle, and H. Beuther. *Industr. Engng Chem.*, 1949, **41** (2), 417–423.—The operating conditions of the Polyform process—high temp, high pressure, and cracking in the presence of recirculated C_3 and C_4 hydrocarbons—are responsible for most of the physical properties of the Polyform distillate. Such properties include high overall volatility, higher content of low-boiling material, and lower content of high-boiling material than most other gasolines. The distillates are rich in low-boiling olefins and aromatics, lean in high-boiling olefins. O.N.s are high, blending values and road performance are excellent. Cat treatment produces good aviation base stock. Comparison is made with straight-run, thermally and cat-cracked gasolines with respect to precision chemical analysis and actual road performance. R. G. T.

Absorption and Adsorption.

983. Adsorption (Review). B. L. Harris. *Industr. Engng Chem.*, 1949, **41** (1), 15–19.—A short review of recent theoretical developments is followed by an account of the industrial aspects of equilibrium adsorption. The more common adsorbents, charcoal, magnesia, etc., are mentioned, and the relation between adsorption and catalysis is reviewed. Adsorption from liquid phase is widely used. An extensive bibliography is appended. R. G. T.

984. Absorption and Humidification (Review). M. C. Carlson. *Industr. Engng Chem.*, 1949, **41** (1), 12–15.—This review deals mainly with absorption in packed towers and liquid distribution therein. Oil absorption, and absorption with chemical reaction, is also discussed. R. G. T.

Solvent Extraction and Dewaxing.

985. Solvent Extraction (Review). J. C. Elgin. *Industr. Engng Chem.*, 1949, **41** (1), 35–38.—New systems for which solubility and tie-line data have been reported are listed. The development of theories for non-ideal solutions and of methods of predicting and correlating data is reviewed. An account of laboratory practice and large-scale equipment and practice is followed by applications of solvent extraction. An extensive bibliography is included. R. G. T.

986. The Solexol Process. H. J. Passino. *Industr. Engng Chem.*, 1949, **41** (2), 280–287. (*A.C.S. Symposium, Univ. of Minnesota*, Mar. 1947.)—Solexol process consists in countercurrent extraction of animal, vegetable, and marine oils and fats using liq propane. Flow diagrams are given showing application of process to refining and fractionation of various oils. Various properties of the fractions obtained from the different oils by the Solexol process are tabulated. R. G. T.

987. Wax Crystallization from Propane Solution. N. F. Chamberlain, J. A. Dinwiddie, and J. L. Franklin. *Industr. Engng Chem.*, 1949, **41** (3), 566–570.—Microscopic studies of wax, crystallized from a Mid-Continent paraffin distillate, were made with a view to solving the problem of propane dewaxing. A pressure cold stage enabled wax crystals to be observed in their normal environment at various stages of the chilling period. With no dewaxing aid present, crystallization resulted in plates in a flat or honeycomb structure. Using a little asphalt as dewaxing aid, spherical particles of unknown structure (nuclei) were obtained immediately below the crystal point. As the temp was lowered each nucleus was surrounded by a shell of radiating needles. With large amounts of asphalt many small nuclei formed at the crystal point and grew slowly until the filtering temp was reached, no shell of radiating needles being formed. Filtering characteristics were found to depend on the type of wax structure present. R. G. T.

Cracking.

988. Various Refinery Applications of Houdriflow Catalytic Cracking. G. F. Hornaday, H. D. Noll, G. C. Peavy, and W. Weinrich. *Oil Gas J.*, 7.4.49, **47** (**49**), 90.—The excess of supply of distillate and residual fuel in the U.S.A. has led to a re-examination of the economics of refining cracking operations, four of which have been selected for study. They include thermal, cat-cracking and vacuum distillation, visbreaking, and delayed coking of the deduced crude.

Three diagrams for thermal and vacuum flashing, and visbreaking and coking schemes are given, and tables show Houdriflow and thermal-cracking yields, and matters such as effect of fuel price on pay-out time and of gasoline price on earnings.

It is concluded that coking and visbreaking are the best methods for preparing cat-cracking charging stocks; and that more cat-cracking capacity is necessary and advantageous to minimize the production of residual fuel. G. A. C.

989. Platforming—A New Catalytic Reforming Process for Improving Straight-Run and Natural Gasoline. E. F. Nelson. *Oil Gas J.*, 7.4.49, **47** (49), 95.—The new process is used by the Universal Oil Products Co., platinum being the catalyst.

In "platforming," naphthenes are converted to aromatics, high-boiling paraffins to lower-boiling ones, and low-boiling paraffins are isomerized.

Tables give comparison of yields in reforming a 200–400° F Mid-Continent naphtha by various methods as against "platforming," and show typical results in processing various charge stocks. G. A. C.

990. Mid-Continent's Modernization Program Includes "Heat Balanced" Cat Cracker. D. G. Morgan. *Oil Gas J.*, 24.3.49, **47** (47), 218.—A brief description is given of the modernization and expansion of the Mid-Continent Petroleum Corporation's West Tulsa Refinery, completed in 1948, which increased its capacity from 33,000 b.d. to 45,000 b.d., at a cost of $8,500,000. The work included a new fluid cat-cracking plant of 13,500 b.d. called a "heat balanced unit" by its designers the W. M. Kellogg Co. This plant embodies a number of new features not previously incorporated in a single plant, *i.e.*, an internal spent-catalyst stripper, a circular instead of a rectangular

precipitator, a hook-up for utilizing the heat from slurry and flue-gas-cooling operations for steam generation, and the regenerator lining which is a "gunite" applied refractory material. The expansion also included: (1) the revamping of crude-oil-distillation equipment; (2) enlargement of cat polymerization plant; (3) increase in capacity of the gasoline-treating facilities; (4) new facilities for H_2S removal; (5) the enlargement of steam-raising plant and cooling-tower equipment, etc.; the whole enabling a complete range of petroleum products to be manufactured. The operations are described and a flow sheet shows that about 60% and 40% respectively of low-wax and higher-wax-content crudes are passed through two distillation plants, each consisting of atmospheric and vacuum units, and the appropriate products therefrom through viscosity-breaking, thermal and cat cracking, polymerizing, propane-treating, solvent-extracting and solvent-dewaxing units, are converted to two motor gasolines, kerosine, diesel and other fuels, neutral oils, bright stocks, petrolatums, and wax products. Products are briefly outlined, and photographs of some of the special units are illustrated. W. H. C.

991. Suspensoid Cracking Pilot Plant. J. W. Flanagan. *Industr. Engng Chem.*, 1949, **41** (1), 211–215.—A pilot plant is described of 3 g.p.h. capacity for the study of the suspensoid cat-cracking process. Flow plan, equipment, and plant operation are shown. Studies on new cats, feed stocks, and operating conditions, and runs to check refinery tests on commercial units are possible. The pilot-plant results check with refinery runs, and can thus be used to predict product yields and quality.

R. G. T.

992. Pore-Size Distribution in Porous Materials. Application of High Pressure Mercury Porosimeter to Cracking Catalysts. L. C. Drake. *Industr. Engng Chem.*, 1949, **41** (4), 780–785.—Determination of macropore-size distribution in porous materials in the pore dia range 200–35 Å, has been made using the technique employed over the range 85,000–200 Å pore dia. The method is based on the principle of Washburn that for const surface tension and contact angle the dia of a pore penetrable by Hg is a direct function of the applied pressure. Pressures from 25 to 60,000 p.s.i. were used in this case. The apparatus and operation techniques are described.

Application to three types of commercial cracking cat, including activated clay and SiO_2–Al_2O_3 gels in the form of gel beads and pellets, indicate wide variations in the pore-size distribution of these materials. Limitations of the method are included.

R. G. T.

993. Pyrolysis of 2-Pentene and Trimethylethylene. H. J. Hepp and F. E. Frey. *Industr. Engng Chem.*, 1949, **41** (4), 827–830.—Pyrolysis of trimethylethylene and 2-pentene was carried out in quartz, by a flow method, between 778° and 850° C in the presence of steam. Cracking occurred producing butadiene from 2-pentene—33–55 mols per 100 mols of 2-pentene depending on temp and dilution. Pentadiene was also formed—10 mols/100 mols reacted. Ethane and butene were primary reaction products with butadiene, ethylene, and propylene. Trimethylethylene yields isoprene as a major product—38·3 mols/100 mols reacted. Butadiene is produced—10 mols/100 mols reacted and butylenes of the order of 10 mols/100 mols reacted. The kinetics and reaction mechanism are briefly discussed. R. G. T.

994. Thermofor Pyrolytic Cracking. S. C. Eastwood and A. E. Potas. *Chem. Engng*, 1948, **55** (9), 113.—(See Abstract Nos. 1663 (1948), 447, and 451.)

Hydrogenation.

995. Thermal Efficiency of Coal Hydrogenation. L. C. Skinner, R. G. Dressler, C. C. Chaffee, S. G. Miller, and L. L. Hirst. *Industr. Engng Chem.*, 1949, **41** (1), 87–95.—Discussion and comparison of the thermal efficiency of a coal-hydrogenation plant with that of a typical German plant is given in detail. A plant is designed for improved thermal eff (overall eff −55%). For the calc the plant is divided into three parts: hydrogenation, hydrogen manufacture, and power. Detailed data, flow sheets with heat and material balances, and comparisons with German eff are included for each

section. The increase in eff and decrease in plant costs show the need for an intense development study. R. G. T.

Chemical and Physical Refining.

996. Mercaptan Formation in Acid Treatment of Pressure Distillate. C. R. Wilke and W. J. Wride. *Industr. Engng Chem.*, 1949, **41** (2), 395–399.—Appreciable quantities of mercaptans can be formed in the acid treatment of pressure distillate containing H_2S. Experimental data suggest the H_2S combines with olefins, the acid acting as cat. The mercaptan increases are large enough to justify removal of H_2S prior to acid treatment, especially in manufacture of motor fuel. The formation of disulphide was also observed. Caprylene Skellysolve mixtures gave similar effects. The influence of temp, acid strength, and acid quantity was studied over a range of industrial conditions. R. G. T.

997. Sulphuric Acid versus Construction Materials. E. C. Fetter. *Chem. Engng*, 1948, **55** (8), 219–236.—Typical materials of construction are evaluated for services involving H_2SO_4. Chemical stoneware is not attacked, but has many limitations. Lead is most widely used and has many advantages; its applications are extensively reviewed. Chlorimet, a nickel–molybdenum alloy is recommended. Various protective coatings, polyvinyl chloride, polystyrene, and polyvinylidene chloride are quite resistant to conc H_2SO_4. Nickel and its alloys are used under special conditions. R. G. T.

998. Crystallization (Review). C. S. Grove, Jr., and J. B. Gray. *Industr. Engng Chem.*, 1949, **41** (1), 22–25.—The theoretical approach to determination of crystallization rate lags behind industrial practice, which is extensively reviewed. R. G. T.

999. Filtration (Review). S. G. Miller. *Industr. Engng Chem.*, 1949, **41** (1), 38–41.—A brief review of filtration theory and industrial equipment and application is concluded by an extensive bibliography. R. G. T.

1000. Mixing (Review). J. H. Rushton. *Industr. Engng Chem.*, 1949, **41** (1), 61–64.—Industrial applications are reviewed with the influence of vessel, other fittings, baffles speed, and pressure on mixing efficiency. R. G. T.

Special Processes.

1001. Combustion with Oxygen and Oxygen-enriched Air. Part 2. Determination of the True Composition of the Products of Theoretical Combustion with Oxygen and Oxygen–Nitrogen Mixtures at Temperatures up to 2500° C at Atmospheric Pressure. H. R. Fehling and T. Leser. *J. Inst. Fuel*, 1949, **22** (124), 123–128. (For part 1, see Abstract 253.)—In combustion with pure air the composition of reaction products can be calc, since dissociation is low, but when oxygen or oxygen-enriched air is used it is impossible to predict the nature of the flame and its effects in the furnace without knowing the exact value of the dissociation. Difficulty in calc the gas composition at high temp arises from determination of the thermodynamic equilibrium conditions and has hindered progress. A simplified solution of the general equations is given for combustion with oxygen and oxygen–nitrogen mixtures. The paper ends with a summary of the method and an example of its application to a specific problem. R. G. T.

1002. Dehydrogenation of *iso*Propylbenzene to Alpha-Methylstyrene. J. E. Nickels, G. A. Webb, W. Heintzelman, and B. B. Corson. *Industr. Engng Chem.*, 1949, **41** (3), 563–565.—α-Methylstyrene is a valuable homologue of styrene and can be obtained from *iso*propylbenzene by cat dehydrogenation at 600–650° C in absence or presence of diluent steam. Use of cat is advantageous with regard to selectivity, conversion per pass, and ultimate yield. A 216-hr cat run gave an average α-methylstyrene production per pass of 43%; ultimate yields of α-methylstyrene and styrene were 71 and 10%; H_2 content of exit gas was 96 mol-%. R. G. T.

1003. New Xylidine Process Revealed. R. L. de Largey, J. P. Okie, and L. M. Roberts. *Chem. Engng*, 1948, **55** (10), 124–126.—Shortage of 100-octane gasoline inspired

research into production of blending agents. Amino-aromatics were found to possess desirable qualities—stability, anti-knock performance, low f.p., solubility, feasibility of manufacture, and availability of raw materials. Process involves nitration of xylene, purification of nitroxylene, and hydrogenation to xylidene. Process details and constructional problems are discussed. R. G. T.

Metering and Control.

1004. A Falling-sphere Viscometer for Use with Opaque Liquids. A. M. Thompson. *J. sci. Instrum.*, 1949, **26**, 75.—A method is described for indicating the passage of the sphere past the reference marks of a falling-sphere viscometer. The method applies to opaque liquids and depends on the alteration of the inductance of a coil as the steel sphere passes through it. Two coils are used for each reference mark. They are connected in a bridge circuit, which is balanced when the sphere passes the reference mark. Indication is obtained from a phase-selective rectifier and meter.
C. N. T.

Safety Precautions.

1005. Unusual Symptoms in Petrol-Tank Cleaners. I. Singh. *Brit. Med. J.*, 1949, i, 706–710.—Detailed case histories (including extensive blood tests) are given of two men hospitalized for 96 days after working unprotected for 7 hr in cleaning a non-gas-freed tank used for storage of leaded gasoline. Unusual features included acute Parkinsonism, hæmoglobinuria, abdominal pain simulating appendicitis, erythrocytosis, and pallor. No significant amounts of Pb could be detected in the urine. In addition to symptomatic dietary treatment, antivenene was injected to arrest hæmolysis. A 12-month follow-up indicated complete recovery. A brief review of previous published cases of intoxication by gasoline (leaded and unleaded) is given. V. B.

PRODUCTS.

Chemistry and Physics.

1006. Studies on Aluminium Soaps. I. Viscosity and Streaming Birefringence of Aluminium Soap Solutions. V. R. Gray and A. E. Alexander. *J. Phys. & Colloid Chem.*, 1949, **53** (1), 9–23.—Viscosities of dil benzene solutions of a series of aluminium soaps of purified saturated fatty acids were measured in an Ostwald viscometer at 25° C. The soaps were prepared by an aqueous precipitation method. It would appear that at infinite dilution the units approach single molecules, with a strong intermolecular force which causes a rapid increase of visc with concn.

Streaming birefringence and viscosity measurements on 1 and 2% solutions were made in a coaxial cylinder apparatus, rates of shear up to 500 sec^{-1} being employed. The effects of the addition of a peptizer and of a non-solvent were investigated. It is concluded that the soap molecules aggregate to form long fibrous miscelles with fatty-acid chains extended sideways. D. F. J.

1007. Use of Aluminium Soap and Other Fuel Thickeners in Gelling Gasolines. W. H. C. Rueggeberg. *J. Phys. & Colloid Chem.*, 1948, **52** (9), 1444–1459.—An account is given of various substances used to gel incendiary fuels. Napalin, an aluminium soap, is studied in detail from the standpoints of chemistry, manufacture, stability, effect of moisture, and gasoline quality. D. F. J.

1008. Investigations on Detonation and Deflagration in Gaseous Mixtures. H. Guénoche. *Rev. Inst. franç. Pétrole*, 1949, **4**, 15–36, 48–69.—A comprehensive theoretical and experimental study of flame propagation in gas mixtures, based chiefly on work with oxygen–acetylene mixtures. Factors such as the dimensions of the combustion tube, length of ignition spark, and the effect of a wire spiral placed in the tube were studied in detail. The following chapter headings indicate the scope of this monograph: experimental method and equipment; propagation of shock and combustion waves in O_2–C_2H_2 mixtures; influence of the conditions at the longitudinal limits on the propagation of deflagration in gas mixtures; influence of the

conditions at the transverse limits on the propagation of shock and combustion waves. Fifty-one references. V. B.

1009. Theoretical Resolution Limit of the Electron Microscope. O. Scherzer. *J. appl. Phys.*, 1949, **20** (1), 20–29.—The effects of focusing, illumination, and aperture on the resolving power and the contrast in the image are calc. The limit of resolution may be changed by a factor of about 3, and the contrast in the image of an atom is appreciably increased by defocusing and spherical aberration. It is to be expected that single atoms will be visible as soon as one of the methods of spherical correction proves to be practically feasible. D. F. J.

1010. Rheological Properties of Incendiary Gels. L. Finkelstein. *J. Phys. & Colloid Chem.*, 1948, **52** (9), 1460–1471.—Various methods are described for the qualitative and quantitative evaluation of the visco-elastic properties of incendiary gels. Correlation between these methods is briefly considered. D. F. J.

1011. Equation of State (Generalized Correlation Applicable to all Phases). W. F. Rush and B. W. Gamson. *Industr. Engng Chem.*, 1949, **41** (1), 78–81.—An equation of state applicable to liq, vapour, and uniform phase is useful in problems relating to vapour–liq equilibrium and thermodynamic properties of materials. A correlation is given which allows evaluation of the consts in the McLeod equation with only a knowledge of the crit consts. Kay's pseudocritical concept permits the extension of the correlation to mixtures. Comparison with experimental values is reasonable. R. G. T.

1012. Calculation of Liquid Densities at Elevated Temperatures. E. S. Hanson. *Industr. Engng Chem.*, 1949, **41** (1), 96–99.—Calculations of the density of liquids other than paraffin hydrocarbons at temps from normal b.p. to near the crit. temp. are based on the principle of corresponding states. The only data used are the crit. temp. and density of the liq at any temp above Tr = 0·5. R. G. T.

1013. Infinite Points of Cox Chart Families and dt/dP Values at any Pressure. (Mathematical Formulae.) R. R. Dreisbach and R. S. Spencer. *Industr. Engng Chem.*, 1949, **41** (1), 176–181.—Equations have been developed expressing $t \infty$ and $P \infty$ (the temp and pressure at the infinite point—*i.e.*, the point at which the v.p.–temp curves of a family meet when plotted on a Cox chart) in terms of two consts of each compound. Differentiations of the Antoine equation gives dt/dP (the rate of change of temp with pressure) at any pressure accurately to the b.p. and probably to several atm. The lat. ht. of vaporization at any temp may now be accurately calc, by use of Clapeyron equation and Haggenmacher's correction, from the dt/dP value. Nomographs are included giving the correction to bar b. p. and 760 mm b. p. for the benzene family, and giving the pressure corresponding to any temp. Tables are shown which give the value of dt/dP and the above two consts at every 10° C for the benzene, naphthalene, and aromatic hydrocarbon families. R. G. T.

1014. Mechanism of the Oxidation of Drying Oils. P. O. Powers. *Industr. Engng Chem.*, 1949, **41** (2), 304–309. (*A.C.S. Symposium, University of Minnesota*, Mar. 1947.)—Oxidation of drying oils in air involves peroxide formation, peroxide decomposition, polymerization, and degradative oxidation. Inhibitors cause an induction period prior to oxidation. Hydroperoxides have been found especially during oxidation under mild conditions, and cyclic peroxides are suggested as products. Peroxides decompose by dehydration and reduction and may be associated with polymerization. Mechanism of polymerization is discussed—main evidence is of chains formed through carbon-to-carbon links. R. G. T.

1015. Nomographs for Bubble and Dew Points. (Benzene–Toluene–Xylene Mixtures.) M. H. Chetrick. *Industr. Engng Chem.*, 1949, **41** (2), 430–431.—Bubble and dew points of mixtures of benzene, toluene, and *m*-xylene can be calc by a rapid method. Nomographs for this three-component system have been constructed, and their use is illustrated. R. G. T.

1016. Inhibition of the Low Temperature Polymerization of *iso*Butene. C. Horrex and F. T. Perkins. *Nature*, 1949, **163**, 486.—The effect of *t*-butanol, ether, and di-*iso*-butene on the low-temperature polymerization of *iso*butene by BF_3 has been studied. The reactions were followed by measuring the temperature rises due to the heat of polymerization; and reaction of the mixture of monomer, solvent (hexane), and inhibitor at $-65°$ C was initiated by circulating BF_3 and N_2 continuously through the solution. Yields were estimated by the amount of Br_2 consumed by the residual monomer, and also by weighing the dried polymer after precipitation with alcohol. The molecular weight of the polymer was calculated from the intrinsic viscosity of the solutions.

The yield of polymer (88–100%) was not affected by the inhibitors. In the absence of inhibitor the temperature rise was completed in 35–45 sec, and a product of mol. wt. 40,500–55,000 was obtained. The addition of *t*-butanol or ether increased the reaction time to 160 and 200 sec respectively, and in the former case a polymer of mol. wt. 11,100–13,700 was obtained. With di-*iso*butene the reaction time was 40 sec and the product had a mol. wt. of 5600. These facts can be explained on the basis of the carbonium-ion theory of Friedel–Crafts polymerizations. H. C. E.

1017. Thermal Decomposition of Complex Molecules. C. C. Coffin. *Canad. J. Res.*, 1948, **26B** (9), 643–646.—Methylene diacetate, paraldehyde, and their homologues decompose in the gaseous state by a unimolecular mechanism at temp low enough to ensure the absence of free radical complications. The effect of molecular structure on the activation energies, frequency factors, etc., of these and other decompositions are discussed. (Author's abstract.) D. F. J.

1018. Vaporization of Liquid Hydrocarbon Mixtures into Air—(Equilibrium and Rate Studies). G. G. Lamb and L. J. O'Brien. *Industr. Engng Chem.*, 1949, **41** (1), 182–189.—Equilibrium and rate phenomena associated with vaporization of fuel prior to combustion in aircraft engines have been studied. In spite of lack of experimental data applicable to aircraft engines, it is suggested that the rate concept, as represented by mass transfer between phases across a laminar film resistance, presents a ready means of defining fuel vaporization in terms of composition, time available for vaporization, pressure, and temp. The equations related to batch differential distillation, if applied at 1 atm, represent a means of calculating experimental A.S.T.M. distillation, vapour, and liq compositions. The equilibrium flash distillation calculation can be used to determine liq and vapour compositions related to a corresponding equilibrium air distillation. R. G. T.

1019. Latent Heat of Vaporization. J. C. Mu, M. Dmytryszyn, J. J. Moder, and R. L. Overbeck. *Industr. Engng Chem.*, 1949, **41** (1), 131–135.—A series of equations relating the heat of vaporization of various classes of compounds to normal b.p. and parachor is derived from Kistyakowskii's equation. For paraffin hydrocarbons the relation is further developed to correlate heat of vaporization with structural formula of the hydrocarbon. Seventy-three paraffins have been tested—max error is less than $\pm 5\%$. Two nomographs are included which enable prediction of latent heat of vaporization from number of carbon atoms, polarity No., and path No. The first is derived from theoretical equations, and the second is empirically corrected for deviation from the literature values. R. G. T.

1020. Viscosity Temperature Characteristics of Hydrocarbons. R. T. Sanderson. *Industr. Engng Chem.*, 1949, **41** (2), 368–374.—Kin visc–temp characteristics are evaluated on visc–temp No. (V.T.N.) basis. Correlations of visc, V.T.N.'s and mol. wts. of homologous compounds are presented. V.T.N. is used to evaluate effect of structure on visc–temp of pure hydrocarbons. The same basic principle can be applied to calc visc of multicomponent mixtures and to predict the effect of oil V.I. improver blends. R. G. T.

1021. A Relative Viscosity–Temperature Number. R. T. Sanderson. *Industr. Engng Chem.*, 1949, **41** (2), 374–378.—The relative visc–temp No. indicates how the kin. visc *vs* temp curve of a liq compares with the curve for a hypothetical standard pure compound having the same visc at 210° F. The No. is proposed as a possible replace-

ment of V.I., and the standard is chosen so that dependence of visc on temp is min. A nomograph relating kin visc at 100° F, at 210° F, and relative visc–temp No. is given. R. G. T.

1022. Phase Equilibria in Hydrocarbon Systems (Volumetric Behaviour of Propane). H. H. Reamer, B. H. Sage, and W. N. Lacey. *Industr. Engng Chem.*, 1949, **41** (3), 482–484.—The molal vol of propane was determined at nine temps between 100° and 460° F and for pressures between the v.p. and 10,000 p.s.i. or between the crit. temp. and pressures as low as 650 p.s.i. Volumetric measurements are smoothed with respect to temp and pressure. The results are tabulated and compared with those of earlier investigators. R. G. T.

1023. Phase Equilibria in Hydrocarbon Systems (The *n*-Butane–Carbon Dioxide System). R. H. Olds, H. H. Reamer, B. H. Sage, and W. N. Lacey. *Industr. Engng Chem.*, 1949, **41** (3), 475–482.—Volumetric behaviour of five mixtures of *n*-butane and CO_2 was investigated up to 10,000 p.s.i. and at seven temps between 100° and 460° F. Tabular and graphical results are supplied. Co-existing compositions of liq and vapour phases were determined for all temps below crit. temp. of *n*-butane. The results of the study of the composition of co-existing phases are compared with earlier investigators' results. R. G. T.

1024. Kinetics of the Interaction of Atomic Hydrogen with Olefins. I. Apparatus and Use of Para-Hydrogen Techniques. H. W. Melville and J. C. Robb. *Proc. roy. Soc. A.*, 22.4.49, **196** (1047), 445.—Normal techniques for investigation of radical reactions are inapplicable to reactions involving hydrogen–olefin additions, since this type of reaction is too fast. A new type of reaction involving the removal of a hydrogen atom on a layer of molybdenum oxide or tungsten oxide has been utilized, carried out in a special vessel in which the path length offered to a hydrogen atom before removal on the oxide layer can be varied. A colorimetric technique has been devised for measuring rate of addition of hydrogen atoms to the oxide surface.

The para-hydrogen-conversion technique has been applied to illustrate how the collision efficiency of a hydrogen atom with a saturated hydrocarbon molecule can be obtained, and also to demonstrate the efficiency of the removal of a hydrogen atom on the oxides of molybdenum and tungsten.

There are ten literature references. W. M. H.

1025. Kinetics of the Interaction of Atomic Hydrogen with Olefins. II. Diffusion Theory. H. W. Melville and J. C. Robb. *Proc. roy. Soc. A.*, 22.4.49, **196** (1047), 466.—A system is described in which diffusion of a hydrogen atom takes place effectively in one dimension.

In a reaction such as $H + C_2H_4 = C_2H_5$, where hydrogen is removed in the gas-phase, the collision efficiency has been related to the fraction of hydrogen atoms which reach the oxide layer under well-defined conditions, and exact differential diffusion equations can be solved. Calc distribution curves of hydrogen-atom concentration throughout the reaction vessel are given under various conditions.

There are eight literature references. W. M. H.

1026. Kinetics of the Interaction of Atomic Hydrogen with Olefins. III. Theory and Technique Involved in Use of the Oxides of Molybdenum and Tungsten as Hydrogen Atom Removers. H. W. Melville and J. C. Robb. *Proc. roy. Soc. A.*, 22.4.49, **196** (1047), 479.—The technique of measuring colorimetrically the rate of addition of hydrogen atoms to the oxides of molybdenum and tungsten is discussed. Alkyl radicals are also removed by molybdenum oxide, and in so doing cause blueing of the oxide surface : allowance is made for this.

Collision efficiencies can be computed from this method without measuring absolute intensities or absolute rates of production of atoms, and construction and operation of a calculator to assist in the computation are described.

There are two literature references. W. M. H.

1027. Kinetics of the Interaction of Atomic Hydrogen with Olefins. IV. Results Obtained by the Foregoing Techniques. H. W. Melville and J. C. Robb. *Proc. roy.*

Soc. A., 22.4.49, **196** (1047), 494.—Using experimental methods and calculations described in previous papers in this series, data have been obtained on reactions of the type $H + C_nH_{2n} = C_nH_{2n} + 1$. Olefins employed were ethylene, propylene, *iso*butene, *n*-pentene-2 (*cis*) and 2 : 3 : 3-trimethyl-butene-1. Tentative suggestions are put forward as to effect of structure on reactivity of the double bond, but a general figure for collision efficiency of a hydrogen atom with an olefin appears to be between 10^{-3} and 10^{-4}.

A further suggestion that, in computation of collision efficiency, the effective diameter of an intimate part of the molecule in the region of the double bond should be used in preference to the diameter of the whole molecule.

There is one literature reference. W. M. H.

Analysis and Testing.

1028. Assessment-Analysis of Lubricating Oils by Selective Adsorption. C. Zerbe and H. Höter. *Erdöl u. Kohle*, 1949, **2**, 133–141.—Assessment-analysis is examination of a lub. oil to determine the max theoretical yield of high-quality product from a given distillate feed stock. Such a result may be achieved either by selective solvent extraction or by selective adsorption (chromatography). The latter method has the advantage over extraction of being quicker and requiring less material (50 g). Tests were made with two dewaxed Austrian lub.-oil distillates (visc at 100° F, 51·5, and 320 cs), which were examined both by selective adsorption on an acid-activated clay and by countercurrent extraction with furfural. Using a 10 : 1 clay–oil ratio a sharper separation is obtained than by solvent extraction. The oil is dissolved in an equal vol of pet ether which is also used as the eluating solvent, the oil being divided into approx 10 eluate fractions. Resins are removed from the clay with a 70 : 30 $CHCl_3$–CH_3OH mixture.

Description of apparatus and analytical technique is given, and detailed analyses of all the fractions on several runs are tabulated and shown graphically. Examination of the results shows that a very close correlation exists between V.I. and n_D, the relationship being linear down to a V.I. of about 30–50. When the base data for a distillate have been obtained the max yield of any given quality of lube therefrom can be calc from measurements of n_D on eluate fractions and blends thereof. Curves are given showing the close agreement between adsorption and solvent-extraction results and also between n_D and V.I. For the oils examined, a V.I. range of 40–100 corresponds to a n_D variation of approx 0·040. Application of the method to synthetic lubricants is discussed, the greater homogeneity of these is clearly shown by chromatographic analysis. V. B.

1029. Composition of Vapours from Boiling Binary Solutions (Systems with *m*- or *p*-Cresols as one Component). D. F. Othmer, S. A. Savitt, A. Krasner, A. M. Goldberg, and D. Markowitz. *Industr. Engng Chem.*, 1949, **41** (3), 572–574.—Methods of *Industr. Engng Chem.*, 1943, **35**, 615, were used in determination of vapour–liq, equilibrium data for systems having *m*- or *p*-cresol as one component. The other components were various alkylnaphthalenes, ethylene and diethylene glycol, acetonyl acetone, glycol diacetate, ethylhexoic acid, carbitol, methyl carbitol, diethyl carbitol, and tetradecanol. A study of activity coeff plots made from the experimental data of these twenty-eight binary systems showed that the second components could not be used for separation of *m*- and *p*-cresols from their mixture by azeotropic or extractive distillation. R. G. T.

1030. Silica Gel Fractionation of 300-Viscosity Lubricating Oil. R. R. Hibbard. *Industr. Engng Chem.*, 1949, **41** (1), 197–200.—Chromatographic fractionation of 300-viscosity red oil into its hydrocarbon types was used in study of factors involved in lub. oil oxidation. The fractions were tested for physical and chem properties. Blends with 10% of the various aromatic fractions were run in the Soho oxidation test, and tendency to form sludge, pentane-insoluble material, and acids, was related to hydrocarbon type. The work confirms Denison's work, which shows that natural inhibitors in lub. oil are sulphur compounds. A small fraction, most strongly adsorbed on silica gel, was a useful inhibitor in all respects. R. G. T.

1031. Apparatus for Fractional Distillation under Reduced Pressure. J. B. Bowen. *Chemical Education*, April 1949, **26** (4), 186.—An apparatus is described for fractional distillation under reduced pressure. It is made of Pyrex glass and incorporated in the device for separating the fractions, is an efficient Schirm type of condenser, which obviates the necessity for an unwieldly set-up involving a separate condenser leading into one of the numerous fractionating devices such as that of Thorne. The design of the condenser prevents external condensation of moisture on the apparatus, and because of its clean drainage it can be used successfully for the vacuum distillation of quite small volumes of liquids. Often a volatile fraction has to be distilled off at atm pressure before a residual product can be distilled under reduced pressure. With the apparatus described these operations can be done consecutively without any dismantling. Even large quantities of ether can be conveniently dealt with.
A. S.

1032. The Grignard Reagent in Hydrocarbon Synthesis. C. E. Boord, A. L. Henne, K. W. Greenlee, W. L. Perilstein, and J. M. Derfer. *Industr. Engng Chem.*, 1949, **41** (3), 609–616.—Special metal reactors are used in the application of the Grignard reaction to the preparation of a large number of hydrocarbons on an enlarged laboratory scale. Production and purification are described. Specific data for about thirty hydrocarbons include methods of preparation, yields, physical properties, and literature references. Bibliography is extensive. R. G. T.

1033. Pure Hydrocarbons from Petroleum (Composition of C_6 fraction of Catalytic Gasoline). J. Griswold and J. E. Walkey. *Industr. Engng Chem.*, 1949, **41** (3), 621–627.—Separation of paraffinic from olefinic compounds in a hexane–hexene fraction from thermofor cat gasoline was accomplished by the Distex process. Analysis of the portions by fractional distillation, with refractive indices, an. pts., Br. Nos., and specific dispersions, was carried out. 2 : 2-Dimethylbutane and *n*-hexane were not present in quantity, but the other isomeric hexanes were present in proportions corresponding to equilibrium at cracking temps. Graphical results of the analytical distillations are presented. R. G. T.

1034. Deposition and Oil Deterioration Phenomena (Investigation by means of a Motored Engine). H. Diamond, H. C. Kennedy, and R. G. Larsen. *Industr. Engng Chem.*, 1949, **41** (3), 495–501.—A study of the factors influencing upper-cylinder-deposition phenomena has led to a test in which an engine is motored while the jacket is heated. Ignition, fuel, and valve systems are eliminated and replaced by a system to flood the engine with any desired gas. Deposits formed were shown to be obtainable solely from oxidn at moderate temps. Several additives had a similar effect to that in a regular engine. Several exhaust and blow-by gas components were tested, but only SO_2 appreciably promoted decomposition. R. G. T.

1035. General-Purpose Pilot Plant. G. T. Gwin and L. T. Yule. *Industr. Engng Chem.*, 1949, **41** (4), 862–867.—A wide variety of cat and processing operations in pet refining research and development can be studied by the general-purpose pilot plant herein described. Flexibility is obtained by making piping alterations and inserting various reactor vessels into the plant. Auxiliary equipment for special processes is included. R. G. T.

1036. Polar-Type Rust Inhibitors (Methods of Testing the Rust-Inhibition Properties of Polar Compounds in Oils). H. R. Baker, D. T. Jones, and W. A. Zisman. *Industr. Engng Chem.*, 1949, **41** (1), 137–144.—A previously described theory [cf. *Industr. Engng Chem.*, 1948, **40**, 2338] is used to show that different methods of testing the rust-inhibiting property of polar compounds in oil will emphasize different variables and thus no single test can suffice for research and technical evaluation. Several new special tests are recommended. Data are given on the results of these tests on various types of inhibitors and inhibited fluids. Their significance and application are discussed. Stability of rust-inhibited fluids and present limitations of long-term storage and low-temp solubility are outlined. R. G. T.

1037. Calculating Pressure–Flow Relations for Lubricating Greases. J. W. Wilson and G. H. Smith. *Industr. Engng Chem.*, 1949, **41** (4), 770–776.—More accurate calcula-

tion than was previously possible can be made of the pressure–flow relations for a non-Newtonian flow system. An empirical equation has been developed for this purpose which takes into account the thixotropic change in the flowing material. Numerous experiments with lub. greases satisfy the equation within the limits of experimental error. The effect of pressure upon the apparent visc of lub. oil grease up to approx 1000 p.s.i. has been investigated. Graphs showing correlation of apparent visc with rate of shear are included. R. G. T.

Crude Oil.

1038. Application of a Chromatographic Method of Analysis to the Examination of Crudes from N.W. Germany. K. W. Schneider. *Erdöl u. Kohle*, 1949, **2**, 87–94.—Analyses have been made of crudes from fields of the flank and apex type in North-west Germany; oils from anticline-type fields were not included. Data are given relating the depth at which the oil is found in the various fields to physical characteristics such as *d*, visc, and b.p. (50%). The postulate put forward by Krejci-Graf that, in asphaltic oil deposits, the shallower oils have the higher *d* was in general confirmed. Waterman ring-analysis methods are not applicable to crude oils, but on chromatographing these the separated fractions can be examined. Chromatography was done in pet ether solution on alumina using crude topped to 150° (at 15 mm). Charts are given showing the wt % distribution of the four principal fractions thus separated (high mol. wt. and polar compounds, resins, yellow oil, white oil and cryst material) in relation to the *d* of the crude.

Comparison of the results with the source of the oil indicates that the shallower oils have a higher naphthene content and also a higher content in oxygenated bodies and resins. The theory that paraffins are converted to naphthenes by the action of O_2, a reaction which is thermodynamically possible, is supported by this evidence.

V. B.

1039. Additional Data on Sulfur in Crude Oils. O. C. Blade. *Oil Gas J.*, 31.3.49, **47** (48), 95.—The report supplies additional data to a previous extensive study on the trends of supply of different sulphur-bearing U.S. crude oils. Period concerned is 1945–47 inclusive.

A table shows per cent sulphur content by districts, and shows in general a gradual increase in production of crude oils having over 0·5% sulphur content since 1935; and a graph shows five different curves representing per cent values on sulphur content of U.S.-produced crudes. G. A. C.

Gas.

1040. Corrosion in Natural Gas–Condensate Wells. (pH and Carbon Dioxide Content of Well Waters at Wellhead Pressure.) H. A. Carlson. *Industr. Engng Chem.*, 1949, **41** (3), 644–645.—Corrosion of equipment in natural-gas–condensate wells is related to pH and CO_2 content of well waters at the wellhead pressures. The pH of three well waters saturated with CO_2 at its partial pressure in the well is close to that of waters measured at wellhead pressures and different from that found by routine analysis at atm pressures. Corrosion rate cannot be correlated with iron content or with organic-acid content of the well waters. R. G. T.

1041. Natural Gas Burners for Domestic Use. J. Ostaszewski (Inz) and A. Waliduda (Inz). *Nafta*, Mar. 1948, **4**, 97, 98, 104–106; Apr. 1948, **4**, 137, 138, 144–146; May 1948, **4**, 174–177; June 1948, **4**, 215–218; July and Aug. 1948, **4**, 252–255. [From the work of (Polish) Petroleum Institute.]—Increasing demand for natural gas and the domestic burner for it has made the (Polish) Petroleum Institute invite constructors to submit their ideas to it. The article is a summary of achievement and results.

Unlike the coal-burning stove the natural-gas burner needs very little excess air and no draught. It also requires no primary air. Numerous graphs illustrate this point from the consideration of economy. Details of construction of the natural-gas burner affect the temp of the gases, which in turn affects the "flue losses" (S_K).

$$S_K = \frac{\text{vol of flue gas}}{\text{lower cal. val.}} \times [C_p]_0^t \times (t_b - t_0)$$

where $[C_p]_0^t$ = average sp. ht. of flue gases, t_b = combustion temp, t_0 = room temp; and vol of flue gas = $1 + 9{\cdot}52\,n$

where $$n = \frac{\text{actual air}}{\text{theoretical air}}.$$

Incomplete combustion causes losses (S_{CO}) according to formula:

$$S_{CO}\ (\text{in } \%) = \frac{\text{Cal. Val. of CO}}{\text{Lower Cal. Val.}} \times V_1 \times \%\ \text{CO in gas}$$

where $$V_1 = \frac{\text{vol of dry flue gas produced}}{\text{vol of natural gas burned}}.$$

Several sketches and drawings of natural-gas burners designed especially to be used with the usual Polish tile oven follow, and a table setting out their performance is enclosed.

During tests on natural-gas burners throughput and pressure of fuel was varied to find optimum conditions for each burner. Results are tabulated, and graphs show that best results are obtained by impinging the flame on a brickwork which lowers S_k.

Of other burners the portable type received attention and different designs were thoroughly tested, some satisfactory results being obtained. Several tables are included.

Similarly, the designs for a kitchen burner were tested and results tabulated. Burners were used in conjunction with traditionally designed coal stoves and with special gas-burning stoves. The latter are better. M. S.

Engine Fuels.

1042. The Atomization of Liquid Fuels for Combustion. J. R. Joyce. *J. Inst. Fuel*, **22** (124), 150–156.—Detailed discussion of the mechanism, extent, and basic purpose of atomization is followed by reference to the principal types of atomizer available. The pressure-jet atomizer is described in detail with common faults in design and manufacture. Liquid-fuel combustion is described as a vapour-phase process, the function of atomization being to prepare the less-volatile liquid fuels for vaporization. The importance in liquid-fuel combustion of small-size spray droplets is emphasized, and an account is given of the combustion of an atomized fuel spray. A general description of the wax method of particle-size measurement is included, with a determination of spray characteristics in terms of the parameters x and n in the Rosin–Rammler equation as applied to sprays [$R = 100e^{-(x/\bar{x})^n}$]. The paper concludes with an account of various mechanical, operational, and fuel factors which affect atomization. R. G. T.

1043. Removal of Aldehydes from Diesel Exhaust Gas. R. F. Davis and M. A. Elliott. *Gas Oil Pwr*, 1949, **44**, 37.—It has been established that the irritant properties of diesel exhaust gas are due to its aldehyde content. The threshold of odour perception is 0·3 p.p.m. (expressed as formaldehyde), and that of nasal and eye irritation is 1 p.p.m., so it is desirable to reduce aldehyde concentrations to below these figures.

Scrubbing the gas with water did not provide complete removal, and the efficiency became less as the aldehyde concentration or the temp was increased. Oxidation by chromic acid was partially effective, but corrosion troubles were acute. Reaction of the aldehydes with sodium sulphite was effective, and oxidation of the sulphite itself was inhibited by the addition of hydroquinone. In a full-scale test a solution containing 10% sodium sulphite and 0·5% hydroquinone at 133° F removed all aldehydes for the first 7 hr, and >90% for 15 hr. The apparatus necessary for attachment to diesel units is described. H. C. E.

1044. "Knock" in Internal Combustion Engines. D. Downs and A. D. Walsh. *Nature*, 1949, **163**, 370.—Using a Richardo E6 variable-compression engine, experiments on aurally determined "knock" yielded the following results: (1) Fuels may give rise to "knock" by two mechanisms; one a high-temperature process (as with benzene or methane), and the other a low-temperature process; (2) With benzene, methane, or hydrogen as fuel, formaldehyde and nitrogen peroxide are strong pro-

knocks, whereas in *iso*-octane, formaldehyde is an anti-knock and nitrogen peroxide has a slight pro-knock effect; (3) Methane and hydrogen both have considerable lead response. (See also Abstract No. 481.) H. C. E.

1045. A.S.T.M. Fuel Oil Specifications. Anon. *Gas Oil Pwr*, 1949, **44**, 34.—Taken from "A.S.T.M. Standards on Petroleum Products and Lubricants," the specifications dealing with fuel oil are analyzed and explained. Classifications of the four grade numbers are given, together with the factors—engine size and design, speed and load range and their variability, atmospheric conditions, maintenance costs, and fuel price and availability—influencing the choice of one or another grade of fuel. The relations of these five factors on the O.N., distillation curve, viscosity, carbon residue, sulphur, flash point, pour point, ash, and copper-strip corrosion of the fuel are described. H. C. E.

1046. Frontier Refining Co. Instals Unisol Treating Plant at Cheyenne. H. A. Brown and J. R. Strong. *Oil Gas J.*, 24.3.49, **47** (47), 236.—A description is given of the new treating plant for refining motor gasolines produced from four high-sulphur crude oils at the Frontier Refining Co.'s Cheyenne, Wyoming refinery. The A.P.I. gravity, total sulphur, and hydrogen-sulphide percentages of the crudes from Big Horn, Quealy, Neiber-Worland, and Rangely fields are given. This project involved the conversion of a government aviation-gasoline plant for motor-gasoline manufacture, and the enlarging of Frontier's doctor plant by 100%. From a study of several treating processes it was decided to adopt the Unisol process (caustic–methanol extraction).

The existing equipment at the old HF alkylation area was modified, and as far as possible the pumps, columns, condensers, reboilers, and controls were employed. The primary bauxite towers were used for caustic pre-wash and water washing, Raschig rings replacing the bauxite. The de*iso*pentanizer was used for mercaptan extracting, after slight modifications. The debutanizer was used for caustic stripping, after replacing bubble trays with Carbon Raschig rings and lining lower section with Monel metal.

After welding, the whole column was stress-relieved to prevent caustic embrittlement, and Monel-metal tubes were installed in the caustic stripper reboiler. The channel head was Monel lined, and to avoid Monel lining the shell, the caustic was passed through the tube side of the reboiler. The depentanizer was employed as the methanol column, its reboilers and receivers were not altered. This Unisol plant differs in two ways from the conventional plant. (1) No open stripping steam is used in the caustic or methanol columns, these being heated by the reboilers. Stripping steam for the caustic stripper is obtained by taking water from bottom of methanol column and converting it to steam in the caustic column reboiler. (2) In the mercaptan extractor, contact between reagent and gasoline is more efficiently effected by a jet-type contact than by Raschig rings. A flow sheet of the process is given, and processing results are discussed. Tables show results of Unisol treating, and the inhibitor susceptibility of two gasolines. W. H. C.

Gas Oil and Fuel Oil.

1047. Catalytic Fuel Considerations. Performance Differences with Cracked or Straight Run Oil. B. R. Walsh. *Fuel Oil & Oil Heat*, April 1949, **7** (12), 54.—Cat fuel oils contain more B.Th.U./gal than straight-run oils. Cat processes yield fewer olefins, more aromatics, and are more stable to oxidation in storage tanks. Gasoline from cat-produced fuel oil has a high anti-knock value in the high-boiling-point fraction.

Graphs comparing performance characteristics of different types of burners with S.R. or cat-cracked fuels are given, and brief discussions ensue. In some burners it was necessary to introduce more air with cat fuels, to establish the same CO_2 condition as with S.R. fuel.

It was found that better combustion resulted when a large-orifice nozzle was employed with high-pressure-gun burners. Performance of several types of turbulators for use with high-pressure-gun burners are considered. The simple four-bladed cast-iron turbulator installed at the end of the blast tube gave the best results. Tests conducted in rotary wall-type burners indicate that increased fan diameter, especially with cat-cracked fuel, gives a better mixture of air and oil. In the high-pressure-gun

burner, design of nozzle is important with a view to improving atomization and providing a spray facilitating mixing of air and oil. Properties of fuels tested are given in tabular form. D. K.

Lubricants.

1048. Phillips Oil Co. Operating 100 Per Cent New Compounding Plant at Kansas City. R. C. Wallace and M. T. Buford. *Oil Gas J.*, 24.3.49, **47** (47), 244.—A lay-out plan, four photographs, and details are given of this new compounding installation. One basic feature of this plant is that no tankage is provided for finished blended oils. The oils are blended in automatic machines and packaged as required. Each base stock and additive has separate pumps and lines from storage to the blending machine. This allows for maximum flexibility in the switching of components to provide for the type of finished product needed. The building, 405 ft by 225 ft, encloses all the units for manufacture, offices and laboratory, used-drum inspection, reconditioning and painting sections, new-drum storage, and finished-packaged storage. All operations are served by conveyors. Blending is done in three automatic blending units, of 90 g.p.m. and one of 60 g.p.m., each handling three base oils and three additives simultaneously, de-aerating and dehydrating the hot blend and water-cooling it before delivering it to the drum and can fillers, which deliver volumetric temperature-corrected amounts. The three canning machines are described. Cans and drums are sealed, conveyed, and stacked. The special precautions taken to avoid contamination of materials and products are outlined. W. H. C.

1049. The Incremental Friction Coefficient—a Non-Hydrodynamic Component of Boundary Lubrication. J. T. Burwell and C. D. Strang. *J. appl. Phys.*, 1949, **20** (1), 79–89.—Investigations were made into lubricated sliding friction between a stationary cylinder and a rotating cylinder at right angles. For hard, smooth surfaces the friction force is a straight-line function of the applied load, although this line does not generally pass through the origin. The slope of this line defines a coeff, designated as the incremental-friction coeff $f\Delta$, which is independent of both load and viscous-fluid effects. Investigations of non-fluid friction at reasonable speeds is therefore possible. In many cases $f\Delta$ is found to decrease with increasing speed, U, over at least part of the range. This variation is often an approx linear function of the logarithm of the speed. The curve of $f\Delta$ vs. ln U appears to be characteristic of the chemical structure of the lubricant and of the rubbing surfaces.

$f\Delta$ is not the overall friction coeff although these coeff do approximate at high loads. Hydrodynamic effects were not absent during these experiments, but $f\Delta$ does not include such effects. $f\Delta$ should therefore prove useful in separating and revealing the roles of lubricant and of bearing material in non-fluid-lubricated friction.

D. F. J.

1050. The Load-carrying Ability of Hydrodynamic Oil Films. A. E. Roach. *Mechanical Engineering*, April 1949, **71** (4), 293.—Theoretical studies indicate that the load-carrying capacity of a journal bearing should be infinite. This is not the case in practice, and under certain conditions of bearing operation the load-carrying capacity may become substantially zero. In the study of lubrication several criteria have been proposed for the load-carrying capacity of journal bearings, but with each one there are certain limitations. In fact, it can be said that there is no single criterion for load-carrying capacity. Also in theory the viscosity of the lub. oil is assumed to be constant throughout the oil film. In practice, viscosity often varies widely with temp and slightly with pressure.

Since there is no satisfactory method of measuring the variation of visc within the load-supporting film, it is difficult to appreciate the variation of load-carrying capacity which is reduced with increase in temp. The effect of surface conditions is also the subject of some controversy, and opinion is divided between smooth surfaces and those which are porous or honeycombed. The effect of load conditions is also discussed, as is also the effect of speed conditions. A. S.

1051. Lubricant Films. E. A. Smith. *Airc. Prod.*, May 1949, **11** (127), 173.—The article deals with protection against scuffing by the use of graphitic and bearing-metal films. I. G. B.

1052. Effect of Water and Other Additives on the Fibre Structure of Calcium Soap Greases. D. H. Birdsall and B. B. Farrington. *J. Phys. & Colloid Chem.*, 1948, **52** (9), 1415–1423.—To prevent agglomeration of the soap phase in calcium-soap greases, a stabilizer is added. The stabilizers studied in this work were water, calcium acetate, and stearic acid. Electron micrographs indicate that the fibre or crystalline structure in hydrated calcium-soap greases disintegrates concurrently with the removal of water. Stearic acid and calcium stearate act as fibre builders, but the fibres are radically different in size and shape from those in hydrated grease. For effective stabilization calcium acetate or water must be present in molar concns *ca* $\geqslant$ that of the soap.
D. F. J.

1053. Thixotropic Qualities of Soap–Hydrocarbon Systems. C. J. Boner. *J. Phys. & Colloid Chem.*, 1948, **52** (8), 1383–1390.—Several commercial lub. greases were subjected to shearing stresses. The consistency of each grease was determined by the A.S.T.M. standard-penetration apparatus at various intervals after shearing had ceased. It is reported that soap–mineral-oil systems containing soaps of monovalent metals are less thixotropic over a period of 70 min than are such systems containing soaps of di- and tri-valent metals. Systems containing soaps of the metal of lowest at. wt. in a series are more thixotropic over an extended period than are systems containing heavier metals of the same series.

The structure of lub. greases is discussed in some detail, and twelve references given.
D. F. J.

1054. Viscosity at Rapidly Changing Pressure. F. Charron. *Rev. Inst. franç. Pétrole*, 1949, **4**, 3–14.—The theory of the ballistic viscometer, in which visc is determined by measuring the angular displacement of a hammer and the distance travelled by a piston, is explained, and the equations governing such an instrument are derived. By this method the visc of a fluid during a very short time interval may be measured.

An apparatus is described, in outline, whereby variable shock intensities, resulting in pressures of 100–2000 atm exerted over periods of 0·001–0·05 sec, may be applied. Preliminary experiments with "Shell CY2" and "Mobiloil CW" oils show that at pressures of 1000 atm these increase in visc by factors of 18 and 15·5, whilst the corresponding factor for glycerine is approx 2. At pressures of 2000 atm the oils increase in visc 400 and 230 times respectively. When the pressure was applied instantaneously (sudden shock) the visc values of the oils were considerably lower than those predicted from a knowledge of the pressure exerted. It is suggested that rise of visc with pressure in a lub. oil is not immediate, but subject to a time lag or hysteresis effect. Such an effect would be of importance in lubrication in considering whether an oil film can be adequately maintained in equipment subject to sudden and transitory pressure increases.
V. B.

Bitumen, Asphalt, and Tar.

1055. Salvaging a Pumping Pavement. W. H. Goetz. *Rds and Streets*, Mar. 1949, **92** (3), 48–50.—The dual-lane pavement of U.S. 30, Northern Indiana, was constructed on the plastic, silty-clay soil of the Valparaiso Moraine in 1937, in slabs reinforced with steel mesh with expansion joints every 40 ft but without contraction joints. Salvage is being accomplished as follows:

Concrete patches are being placed in areas where the old pavement is badly broken. All the remaining pavement slabs are being stabilized by pumping water-thin cement slurry (of Standard Portland Cement, calcium-aluminate cement, and water in proportions depending upon weather conditions and the cement being used) through holes drilled in the pavement to fill completely the void created by the pumping slabs. This sets firm in 30 min. Resurfacing with 3 in of asphaltic concrete and rock asphalt is carried out as soon as practical.
R. H.

Special Hydrocarbon Products.

1056. Composition of Colorado Shale-Oil Naphtha. J. S. Ball, G. U. Dinneen, J. R. Smith, C. W. Bailey, and R. V. Meter. *Industr. Engng Chem.*, 1949, **41** (3), 581–587.—Remarkable similarity was found on analysis of naphthas distilled from crude shale

oils produced by several methods of retorting Colorado oil shale. A detailed composition study of one was thus undertaken and revealed that the approx composition of raw shale oil is: paraffins and naphthas 30%; olefins 40%; aromatics 20%; sulphur, nitrogen, and oxygen compounds 10%. Paraffins and olefins, which comprise about two-thirds of their groups, are mainly straight-chain compounds. Sulphur, oxygen, and nitrogen are mainly in the form of thiophenes, phenols, and pyridines respectively. R. G. T.

1057. Application of Science to Modern Fruit-Growing. T. Swarbrick. *J. Roy. Soc. Arts*, 22.4.49, **27** (4793), 261.—Advances made recently in the use of petroleum fractions as pest-control materials are discussed. Emphasis is laid on the following:

1. The use of petroleum oils as ovicides. Spray oils have been shown to contain a narrow fraction possessing a high insecticidal value and occurring at different boiling points for oils of different origin. If, therefore, an oil can be prepared consisting of this highly active fraction, it can be used in very small quantities, and save both oil and phytotoxic damage.

2. Causes of phytotoxicity. By detailed analyses, phytotoxic fractions have been discovered and removed in the laboratory, and it appears that removal of toxic fractions has no effect on boiling range or viscosity of the remainder.

3. Petroleum oils as weed-killers. These may either be total, killing all weeds, or selective, *i.e.*, certain hydrocarbons in the boiling range 80–200° C are toxic to weeds occurring in such crops as carrots and cranberries, and weeds appearing early in beet crops can be controlled by fortified petroleum oil.

4. Vapona or atomized oil sprays. Insecticides can now be applied by motor-powered applicators from helicopters.

5. Frost protection. An oil-burning unit is about to be produced which will transform heat energy into infra-red radiant energy. Also mentioned are plant-growth-regulating substances, micro-nutrients, disease control, and developments in genetics. W. M. H.

1058. Pure Hydrocarbons from Petroleum. (Preparation of Methyl*cyclo*hexane from Straight-Run Heptane Fraction.) J. Griswold and J. W. Morris. *Industr. Engng Chem.*, 1949, **41** (2), 331—336.—The improved Distex pilot plant for the production of high-purity methyl*cyclo*hexane from narrow-boiling, straight-run heptane fraction is described. Constructional details and performance for the four successive operations are given: (1) continuous fractionation removes most of material boiling below *n*-heptane; (2) Distex operation eliminates most of *n*-heptane and remaining lighter materials; (3) repetition of Distex operation removes toluene and some of higher naphthenes; (4) batch fractionation recovers methyl*cyclo*hexane of 99 mol-% purity. R. G. T.

1059. Toxic Hydrocarbons (Properties of Hydrocarbons as Related to Their Wood Preserving Value). J. A. Vaughan. *Industr. Engng Chem.*, 1949, **41** (3), 526–530.—An investigation into the causes underlying toxicity of certain hydrocarbons has led to the development of controls for production of toxic hydrocarbons from any source of hydrocarbon material. The presence of aromatics and an established sp. gr.–b.p. relation may be employed for predicting toxicity towards fungi. R. G. T.

1060. Compounding Rubber with Petroleum Products (Correlation of Chemical Characteristics with Compounding Properties and Analysis of Petroleum Products Used as Compounding Ingredients in Rubber). F. S. Rostler and H. W. Sternberg. *Industr. Engng Chem.*, 1949, **41** (3), 598–608.—Chem analysis of pet products can be used to evaluate them as rubber-compounding ingredients. Five basic groups of compounds have been found in pet products from higher-boiling fractions. These groups have been isolated and tested in compounds with GR-S and natural rubber. All show typical curing characteristics and physical properties. The performance of a pet product in rubber is then shown to depend on type and proportion of basic components in the compounding ingredient. Identification of plasticizers, extenders, and process oils is therefore made easy by this method, which consists of step-wise precipitation with H_2SO_4. Composition variation is considerable, and this simple method can replace

the present practice of mixing and testing a rubber compound for product evaluation. It is generally applicable to all high-boiling pet products and bitumens. R. G. T.

1061. Modern Wax Technology. H. W. Jenkins and H. B. Friedman. *Chemical Education*, Apr. 1949, **26** (4), 182.—The importance of wax in industry has steadily increased ever since its protective qualities were discovered several thousand years ago. The three major classes of the natural waxes are the vegetable waxes, animal waxes, and the mineral waxes. Probably the most important property of a wax to be considered is its hardness, so industry is continually trying to find harder waxes, than those now available. Carnauba wax is the most important wax in the vegetable class. Of the animal and insect waxes, beeswax is by far the oldest and most used, while paraffin wax is the most familiar and most widely used of the mineral waxes.

The production of wax is a natural reaction, and the harvesting and refining of waxes can be carried out in various ways, some of which are described in this article. The future of waxes is very good, since it has innumerable applications, and it now appears possible that new synthetic waxes will soon be produced which will have good properties similar to those of the carnauba and other hard waxes, together with desirable properties of their own. A. S.

Derived Chemical Products.

1062. Emulsification and Detergency. F. C. Harwood. *Chem. Prod*, Apr. 1949, **12** (5), 162.—The properties which are necessary attributes for a good detergent are high wetting power and efficient dirt removal, coupled with rapid dispersal of soil particles in a fine state and suspension of these finely divided particles in solution.

This article deals with laboratory investigation of the subject when the factors examined included measurement of surface and interfacial tensions, contact angles, electrical charges on dispersed particles, penetration of fabric by detergent solutions, absorption, pH values, and suspending powers.

A further factor which must be taken into account is the nature of the surface from which the soil is to be removed, since this influences the choice of detergent for specific applications. The nature of the soil is also important.

Three classes of synthetic detergent are available, namely, anionics, cationics, and non-ionics. Of these the former two are most easily available at present and are, in general, excellent wetting agents. In the opinion of the author, they have not completely achieved the criterion of efficiency reached with soap-alkali formulations in laundry practice, though, in some cases, their use may be preferable. Modified formulations containing such materials are now being investigated. Due to their relatively small availability, little experience of non-ionics has been obtained. O. M.

1063. Synthetic Glycerine. A Milestone in Petrochemical Progress. [Ed.] *Chem. Engng*, 1948, **55** (10), 98–104.—Synthesis of glycerine from pet chemicals has taken glycerine out of the by-product class. One-fifth of U.S. national pre-war output is now produced in Shell plant. Propylene is chlorinated to allyl chloride, and to trichloropropane, which are hydrolyzed with NaOH to glycerine. Chlorhydrination of allyl chloride also produces glycerine through other intermediates. Flow charts of plant and of process organization are included. Other chem engineering achievements of Shell are given—application of distillation, production of aviation gasoline, petrochemicals, synthetic rubber, synthetic aromatics, ethyl alcohol, and allyl derivatives. R. G. T.

1064. Glycerine from Petroleum. J. V. Hightower. *Chem. Engng*, 1948, **55** (9), 96–98.—Plant for the production of synthetic glycerine from propylene is described. Capacity is an appreciable proportion of U.S. consumption (*ca* 200 million lb/yr) and will stabilize price of glycerine. Propylene is separated from other pet hydrocarbons and chlorinated at high temp. The allyl chloride is converted to glycerine by further chlorination and hydrolysis with NaOH and water. Resulting solution is desalted and evaporated under reduced pressure. Purity is over 99%. Economics are discussed. R. G. T.

1065. Chlorination of Hydrocarbons. Chlorination of Ethane. E. T. McBee, H. B. Hass, W. E. Burt, and C. M. Neher. *Industr. Engng Chem.*, 1949, **41** (4), 799–803.—An investigation of thermal and photochemical chlorination of ethane involving the jet-wise introduction of chlorine has been made. Experimental details of apparatus and operation are extensive. The various advantages claimed include accurate temp control, facility of operation, and low Cl_2 concn. The effects of the jets, and of variation of Cl_2 rate, and Cl_2–ethane rate are discussed. R. G. T.

1066. Production of Hexachloro*cyclo*pentadiene. E. T. McBee, C. F. Baranauckas. *Industr. Engng Chem.*, 1949, **41** (4), 806–809.—Hexachloro*cyclo*pentadiene in 75% yield was produced by high-temp chlorination of polychloro-*n*-pentanes, polychloro*iso*-pentanes, and polychloro*cyclo*pentanes at atm pressure. Polychloro*neo*pentanes undergo chlorinolysis rather than chlorination. Polychloro-*n*-hexane, polychloro*iso*-hexanes, and polychloro-2-methyl pentanes were also converted to hexachloro*cyclo*-pentadiene by chlorination. Most suitable charge stocks were polychloropentanes of sp. gr. 1·63–1·7 for chlorination at 470° C. The optimum mol ratio of Cl_2 to polychloro-pentanes having sp. gr. 1·64 was found to be 5·71 : 1. Possible mechanisms of the chlorination are discussed. R. G. T.

1067. Production of Hexachlorobutadiene. E. T. McBee and R. E. Hatton. *Industr. Engng Chem.*, 1949, **41** (4), 809–812.—Hexachlorobutadiene has been produced by chlorination of polychloro butanes at high temp and atm pressure. Chlorinolysis occurs simultaneously yielding carbon tetrachloride, tetrachloroethylene, hexachloro-ethane, and hexachlorobenzene. The charge stock was made from butane or chloro-butanes by photochemical chlorination. The polychlorobutanes produced were passed through a hot tube with Cl_2. Optimum conditions for the production of hexa-chlorobutadiene were studied for the hot-tube method. Yields $\geqslant$75% of the chloro-carbon having conjugated double bonds may be obtained by the new processes. The physical properties of hexachlorobutadiene are briefly described, and the mechanisms of the chlorination and chlorinolysis reactions are discussed. R. G. T.

1068. Chlorination and Chlorinolysis of Propane. E. T. McBee and L. W. Devaney. *Industr. Engng Chem.*, 1949, **41** (4), 803–806.—Preparation is described of chloro-propanes by simultaneous and continuous introduction of Cl_2 and C_3H_8 with an irradiated body of polychloropropanes having approx the sp. gr. of the desired product. Chlorinolysation of the polychloropropanes at atm pressure gives tetrachloroethylene, carbon tetrachloride, and hexachloroethane. The chlorination process produces polychloropropanes with sp. gr. $\simeq$ 1·7 which are suitable charge for chlorinolysis. Temp between 460° and 480° C were most satisfactory for production of tetrachloro-ethylene and carbon tetrachloride.

Jet chlorination and chlorinolysis are also discussed. R. G. T.

Coal, Shale, and Peat.

1069. Low-Temperature Coal Carbonization under Pressure. E. h. A. Thau. *Erdöl u. Kohle*, 1949, **2**, 127–133.—A discussion and description of the Blümner process, in which equal weights of powdered coal and a high-boiling tar or mineral oil are heated to 475° C (max) in a series of sealed retorts at 25–30 atm. A flow diagram, showing yields, is given. Total liq products amount to 27% (wt) (gasoline 10·4, diesel fuel 7·6, fuel oil 9). The residue (7%) resulting from a degasifying stage at >500° C and normal pressure has possibilities as an electrode coke. Other pressure-carbonization pro-cesses are compared and shown to give inferior yields. V. B.

Miscellaneous Products.

1070. American Montan. Anon. *Chem. & Ind.*, Mar. 1949, **64** (3), 379.—Based on information from Germany, a plant is now in operation in America which processes Californian lignite to yield montan wax. The present production is several thousand pounds per day. The lignite is stripped, pulverized, and then extracted to give a liquor containing wax. This wax has a high true-ester wax content and, after refine-ment and general purification, is suitable for use in polishes, carbon-paper, wire coating,

and various wax sprays. All industries requiring a high-melting-point wax are potential customers. O. M.

1071. Development in Wood Preservatives. J. O. Blew. *Chem. & Ind.*, Feb. 1949, **64** (2), 218.—Preservatives are important in wooden structures which are in contact with soil, moist atmospheres, or water, where the growth of fungi is relatively rapid and where marine borers cause damage.

Essentially, to be effective a preservative must (*a*) be toxic to wood-destroying organisms or discourage them from inhabiting the wood; (*b*) have permanence under the existing conditions; (*c*) be readily available and economical to use; and (*d*) be safe to handle. Colour, odour, cleanness, paintability of treated wood, fire resistance, and moisture repellancy are also important.

The evaluation of these materials is somewhat difficult, since it entails long-term, practical trials, though accelerated tests in the laboratory are useful for screening purposes.

Zinc chloride and chromated zinc chloride are useful preservatives for the less-severe conditions. Where a high degree of preservation is required, the standard material is coal-tar creosote. This material can be fortified with pentachlorphenol or copper naphthenate. Pet oils either alone or in admixture with creosote are also used, and here again fortifying agents can be applied. O. M.

Engines and Automotive Equipment.

1072. Research on Aircraft Propulsion Systems. A. Silverstein. *J. Aero. Sci.*, Apr. 1949, **16** (4), 197.—The introduction in the past few years of many new aircraft-engine types has so greatly increased the scope of propulsion-system research that frequent assessments must be made of the problems and goals, and the direction must be determined for the most fruitful application of a limited research effort. A method of analysis is outlined that enables aircraft-propulsion systems to be compared on a common basis, provides an ordered arrangement of the systems according to their use, and indicates the areas in which research effort should be expended to increase the performance of the systems.

Results of extended analyses of this type are summarized, and the conclusions are reached that intensive research effort should be directed toward increasing: (1) the C.R. of gas-turbine engines, (2) the cycle temperatures of gas-turbine engines, (3) combustion efficiencies and intensities, and (4) the operating temperatures of heat-resistant materials. The fundamentals of these problems are discussed, and the research approach to their solution is outlined. Many problems of equal importance could not be mentioned because of the limitations of this presentation. I. G. B.

1073. Causes of Crankcase Explosions. Anon. *Gas Oil Pwr*, 1949, **44**, 35. (Abstract of a meeting held under the auspices of the Diesel Engine Users Association, February 1949.)—The following possible causes of crankcase explosions in diesel engines, and their cure, were discussed:

Oxygen: The crank-chamber vent should be coupled to the exhaust manifold through a flame trap.

Hot Spots: The piston crown, which is the most likely source of danger, should be isolated by means of an insulated piston-head.

Blow-by Gases: These might heat the piston crown to dangerously high temperatures, or incandescent carbon might pass the piston rings and get to the crankcase. These effects will be less well marked with aluminium than with cast-iron pistons.

Overloading: Very bad conditions are set up when a load is suddenly applied after a period of running on light load.

Short descriptions of two explosions due to seized pistons are given. H. C. E.

1074. Double Mamba. Anon. *Flight*, 31.3.49, **55**, 373. The article gives details of a two-engine installation, the Mamba engines driving a single propeller shaft. The cut-away drawing shows the principal components, and details are given of power and consumption curves at sea-level and at 20,000 ft. I. G. B.

1075. Ministry of Transport and Crankcase Explosions. Anon. *Gas Oil Pwr*, 1949, **44**, 50.—The Ministry of Transport Circular dated November 17, 1948, "Explosions in crankcases of compression-ignition engines," issued to shipbuilders, marine-engine builders, and shipowners is reproduced *in extenso*. H. C. E.

1076. Dart Type-tested at 1,250 s.h.p. Anon. *Flight*, 31.3.49, **55**, 362.—Details are given of operation experience and principal characteristics are as follows :—

Two-stage Centrifugal Compressor Two-stage Turbine.	
Mass air flow at max r.p.m.	18 lb/sec
C.R.	5·5 : 1
Overall diameter	38·5 in
Length to exhaust cone	94·75 in
Frontal area	8·10 sq. ft.
Weight without airscrew	850 lb
Weight–power ratio	0·56 lb/h.p.

I. G. B.

1077. Work at Thornton Research Centre II. Delivery-rate Analyzer for Diesel Injection Systems. Anon. *Gas Oil Pwr*, 1949, **44**, 5–8.—The purpose of the analyzer is to find the proportion of the total fuel delivered per cycle from an injector during any portion of the injection period. The apparatus consists of a flanged disc fitted over part of its inner circumference with forty-five compartments separated by knife edges at 1° intervals. The injector is mounted so that the spray from one hole is directed towards the knife edges, and as the disc rotates each compartment receives the fuel discharged during 1° of rotation. The compartments contain blotting-paper to absorb the fuel, and the quantity collected is determined by weighing. The accuracy of the test is improved by collection over a number of injections, and a total of about 0·5 g fuel can be collected in any one compartment.

When a multi-hole injector is tested all but one of the holes are shrouded, the excess fuel being drained away.

Results are represented by plotting grams of fuel collected per degree per 200 injections against the rotation of the disc (and of the pump-shaft). The reproducibility of the apparatus is very good. H. C. E.

1078. German Gas Turbine Work. Anon. *Gas Oil Pwr*, 1949, **44**, 14–16, 46.—These articles deal with gas-turbine development work done by four leading German firms during 1939–45 :—

M.A.N. Augsburg : It was proposed to drive a 12,000-kW turbine on gas produced by the high-pressure gasification of brown coal. The plant would comprise four axial-flow compressors in series, with intercooling between each pair. The air at 20 atm pressure would pass through a heat exchanger to two combustion chambers in parallel supplying two turbines, which would drive the third and fourth compressors. The combined exhaust would pass through two more turbines in series driving the low-pressure compressors and a power-output shaft. Gasification of the coal would be carried out with high-pressure air and steam, and the gross calorific value was calc as 2090 C.H.U./lb. The net output efficiency of the plant would be 28%.

Blohm & Voss : The design for a 7500-h.p. gas turbine for marine use comprised a fourteen-stage axial-flow compressor and a two-stage turbine. The specifications include :—

Mass flow	100 lb/sec
Rotational speed	5400 r.p.m.
Overall efficiency	15%
Fuel consumption	1 lb/h.p.hr

Provision was made for cooling air to be distributed through the turbine blades, and the exhaust to be cooled by additional air so that only a light exhaust casing would be required.

Brückner & Kanis : Two projects were under consideration. The first was a gas turbine with water-cooled blades, rotor, and combustion chamber, worked in con-

junction with a turbine driven by the steam produced from the cooled parts. The unit was designed to give 5000 h.p., and the steam and gas turbines were to be geared together and to the output and compressor shafts. The second project was a 10,000-h.p. unit for use as high-speed marine power-plant, comprising four gas producers supplying hot gases to one power turbine. Each gas producer contained a five-stage pre-compressor, a nine-stage contra-rotating compressor, combustion chamber, and an eight-stage contra-rotating turbine. H. C. E.

1079. Gas Turbine for Road Transport. J. Hodge. *Gas Oil Pwr*, 1949, **44**, 48–49.—The effect on design and performance on the scaling-down of an aero-engine is discussed with reference to speed of rotation, heat exchangers, and Reynolds No. The weight of a turbine will be *ca* 2–3 lb/b.h.p., which compares favourably with that of a conventional engine; and the space occupied will be about the same. Starting will be accomplished by a battery-driven electric motor with automatic switch-on devices, but cannot be performed by towing the vehicle; and conversely no braking effect can be obtained from the engine. Noise is not thought to be a major factor.

H. C. E.

1080. More Engines for Iraq Pipeline. Anon. *Gas Oil Pwr*, 1949, **44**, 31–33.—Thirty-six engines for pumping duties and twenty-seven for auxiliary services are being supplied by Harland & Wolff Ltd. The pumping engines are of the company's standard four-stroke type and will develop approx 950 b.h.p. at 300 r.p.m. The cylinders have bore and stroke of 400 and 600 mm respectively. Fuel-injection equipment includes scroll-plunger control and special fuel valves provided with lapped spindles having flat seats, and a blast-chamber device for minimizing carbon formation on the valve nozzles. Pressure-charging at 3 p.s.i. is employed. Lubrication is by forced feed, and the system is primed by an electrically driven pump. The pistons are oil-cooled, and the temperature of the oil leaving each piston can be separately measured.

The four-stroke auxiliary engines have normal induction, and develop 200 kW at 428 r.p.m. The five cylinders are of 316 mm bore and 380 mm stroke. The same type of fuel-pump and fuel-valves are used as in the larger engines, but the pistons are not oil-cooled. H. C. E.

1081. Quick-running National Marine Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 80.—Adapted for marine use, this four-valve engine has a maximum speed of 1200 r.p.m. with a continuous speed of 800 r.p.m. The six-cylinder unit develops 132 b.h.p. at this speed. Starting is accomplished by a single-cylinder Coventry Victor diesel, operating through a clutch and Bendix pinion. H. C. E.

1082. Nordberg Single-cylinder Four-stroke Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 61.—The type 4FS-1 engine has one cylinder of 4½ in bore and 5½ in stroke, and has a rating of 10 b.h.p. at 1200 r.p.m. and 15 b.h.p. at 1800 r.p.m. Its compression ratio is 15 : 1. Pressure lubrication is provided to crankshaft, connecting-rod, piston-pin, camshaft, and rocker-arm bearings, whilst the piston is splash-lubricated. The lub. oil passes through a float strainer on the suction side of the oil-pump, and then through a heat exchanger within the cylinder block. A by-pass filter continually cleans part of the oil. A thermostatically controlled water-cooling system is provided. The fuel is delivered to the injection pump at 3 p.s.i. through a fuel filter. H. C. E.

1083. Supersonic Wind-Tunnel. O. W. Boden. *Airc. Prod.*, May 1949, **11** (127), 145.—The design of aircraft for speeds greater than that of sound necessitates the use of test equipment in which such speeds can be simulated. After experience gained with a small supersonic wind-tunnel, North American Aviation of Los Angeles, California, have built a larger tunnel of the vacuum-operated intermittent-flow type, in which Mach Nos. of from 1·22 to greater than 5 can be produced. The design of this new tunnel is based upon that of the German installation at Kochel, which began operation in 1937 and in which development work on the V2 rocket was carried out.

I. G. B.

MISCELLANEOUS.

1084. Reserves Solid Fuels and their Suitability for Production of Liquid and Gaseous Fuels. A. O. Fieldner. *Oil Gas J.*, 17.3.49, **47** (46), 138.—Reserves of all mineral fuels in the U.S. estimated at 3·1 trillion tons, based on exploratory drilling especially in western states.

Coal comprises bulk of reserves, and of some 2·5 trillion tons, 15 billion tons are anthracite.

A predominating western source of fuel is oil shale from the Colorado, Wyoming, and Utah areas and estimated to yield 200 billion brl of oil.

Tables show estimated mineral fuel reserves, and coal reserves on a B.Th.U. basis (percentage distribution by grades and provinces). Two maps showing U.S. coalfields are also given. G. A. C.

1085. Impact of Tonnage Oxygen on American Chemical Industry. C. R. Downs. *Chem. Engng*, 1948, **55** (8), 113–117, 121.—The effect of the large quantities of O_2 now available is assessed. A brief account of its production is followed by figures for individual consumer industries, including iron and steel production, hydrocarbon synthesis, and partial oxidation of hydrocarbons. The two principal processes for synthetic liquid fuels, the Bergius and Fischer–Tropsch processes, both use O_2 at some stage, and figures are given for costs relative to pet distillates. O_2 will have a large influence on these relative costs. R. G. T.

1086. North American Operating Refineries: Their Locations, Capacities, and Types. Anon. *Oil Gas J.*, 24.3.49, **47** (47), 269.—A summary of the operating and idle plants in the U.S.A., Canada, and Mexico is given. In the U.S.A. the total crude-oil capacity is 6,515,505 b.d., and cracking capacity, 3,752,390 b.d. The capacities for Canada and Mexico are: 328,800 and 166,800 b.d. and 160,350 and 25,900 b.d. respectively. W. H. C.

1087. Inventory of Midwest Chemical Progress. (Report.) *Chem. Engng*, 1949, **55** (9), 127–130.—A survey of the reasons for growth of industry in the Midwest is followed by a list of expansions. A tabulated census of plants and employees is included, and charts showing comparison with U.S. totals and economic factors are given. R. G. T.

1088. Industrial Migration. (Ed.) *Chem. Engng*, 1948, **55** (8), 110–112.—Migration of industries during the last fifty years is indicated by the growth patterns of the various industrial areas. Wartime requirements, charge in consumer markets, cost differentials, wage differentials, and other factors affecting migration are discussed. The effect on specific regions is described. R. G. T.

1089. Canada's Chemical Progress. (Chem. and Met. Report.) *Chem. Engng*, 1948, **55** (8), 127–134.—Progress in the chem industry of Canada is reviewed, and extensive comparative figures are given for many industries. Pet refining is one of largest. Output figures of various undertakings are included. R. G. T.

1090. Czech Chemical Comeback. E. Fisher. *Chem. Engng*, 1948, **55** (8), 100–101.—A brief review of Czechoslovak chemical recovery includes interesting figures on synthetic-fuel production and costs. R. G. T.

1091. Refinery Maintenance Costs. R. S. Stewart, H. A. Gustafson, R. W. Tryon, H. H. Linnell, D. Bromley, and H. P. Evans. *Oil Gas J.*, 14.4.49, **47** (50), 82.—A symposium on refining maintenance is reported. Subjects dealt with include: (1) costs; (2) specific problems; (3) scheduling; (4) shops.

Under "costs" the use of automatic business machines and procedure for gathering maintenance information are discussed; "specific problems" concerns training programmes, responsibility for lubrication and maintenance of pumps, motors, electrical and compressor equipment, and for cathodic protection against corrosion. "Schedul-

ing " concerns planning use of labour in maintenance programmes, and lay-out, tooling, and training are dealt with under " shops." G. A. C.

1092. Cost-imating Brick and Tile. W. L. Nelson. *Oil Gas J.*, 31.3.49, **47** (48), 125.—No. 24 in the series gives approximate costs of brick, tile, board, mortar or cement, plastic firebrick or clay, and asbestos rope for expansion joints. These materials are mainly for furnaces, boiler settings, etc. Prices are as for 1946. G. A. C.

1093. Cost-imating. Cost of Buildings. W. L. Nelson. *Oil Gas J.*, 17.3.49, **47** (46), 191.—No. 22 in the series gives a table showing approximate building costs in cents per cubic foot for material and labour for such items as industrial buildings of corrugated iron, brick and corrugated asbestos, pump houses, and tropical houses. There are eight literature references. A table shows approximate cost indices from 1926 to 1948. G. A. C.

1094. Cost-imating. Furnace Details. W. L. Nelson. *Oil Gas J.*, 14.4.49, **47** (50), 125.—No. 26 in the series gives approximate cost indices for period 1926–49 for brick and tile, cement, steel and castings, and 1946 costs for pipe-steel construction for labour and material. G. A. C.

1095. Cost-imating Pipe Steels. W. L. Nelson. *Oil Gas J.*, 7.4.49, **47** (49), 109.—No. 25 in the series includes a table showing approximate cost of steam-boilers including erection and stack, and a chart giving approx costs of cracking and dist pipe steels.

An approximate cost-indices table for the period 1926–48 for material and labour is also given. G. A. C.

1096. Cost-imating. Pump and Control Houses. W. L. Nelson. *Oil Gas J.*, 24.3.49, **47** (47), 303.—No. 23 in this series gives a table showing approx costs of materials and labour of the various items comprising pump and control houses. A table shows the cost of paint and painting pump and control houses, for one coat of: primer (iron oxide), aluminium, black and white, and for white paint and painting of tanks. All based on U.S. 1946 prices. W. H. C.

1097. These Short Cuts Will Speed your Design and Estimation of Tanks. E. H. Coe. *Chem. Engng*, 1948, **55** (9), 107–109.—Six charts are presented which enable design and cost estimation of tanks to be made in a fraction of usual time. The charts cover most sizes up to 1000 gal capacity and show tank shell and dished-head volume, thickness of shell, of flat heads and of dished-shell heads, required. Cost *vs* capacity charts are given for flat-head metal and glass-lined tanks. Use of the charts is briefly described. R. G. T.

BOOK REVIEW.

Viscometry. A. C. Merrington. London: Edward Arnold Co., 1949. Pp. 142 + viii. 16*s*. net.

It is important in assessing the value of a book to know for whom it was written. The author of "Viscometry" clarifies this point explicitly in his preface: ". . . the practical research worker for whom the present book is intended, frequently does not wish to make a deep study of the subject." Whilst the practical research worker may not be wise to use any but the rigorously standardized viscometric methods if he "does not wish to make a deep study of the subject," it is probably true that more often than not he does want a simple, concise description of the various viscometric methods available, together with their chief characteristics, but without too much elaboration. This book by Dr Merrington provides well for such needs. Barr's "Monograph" is getting scarce and, therefore, the need for a book on viscometry has become acute.

The first chapter is a very brief review of the development of the science of viscometry and of its units. Incidentally, the author explains the almost universal adoption of the kinematic rather than the absolute units of viscosity by the petroleum industry by the fact that most of the viscometers in the industry measure kinematic viscosity. This, of course, does not explain why the industry adopted such viscometers. Probably the reason is more fundamental: the kinematic viscosity determined whether flow at a particular velocity shall be viscous or turbulent in conduits, pumps, burner atomizers, heat-exchange units, etc., and the oil industry, which is vitally concerned in all these matters, naturally requires a direct measure of the kinematic viscosity. The absolute viscosity measures the forces encountered in viscous flow. Thus, it is more difficult to induce turbulence in, say, natural gas than in, say, liquids like petrol: the kinematic viscosity gives this information directly, absolute viscosity does not. As most of the important properties of fluids flowing in bulk depend on the regime of flow—*e.g.*, coefficients of heat transfer, friction factors, etc.—the importance of kinematic viscosity to the petroleum industry is high.

The second chapter is an excellent summary of capillary viscometers, both of the absolute and relative types. They range from Poiseuille's and Thorpe and Rodger's viscometers of the last century to recent types—*e.g.*, Coe and Godfrey's viscometer of 1944—and include the standard U-tube viscometers. However, as all capillary viscometers are plagued with one common curse called "end effects," it is necessary to comment on the treatment of this subject by the author. The author does not cover work that was subsequent to Dr Barr's publication of his book—*e.g.*, Langhaar's work (*J. appl. Mech.*, 1942, **9**, A55) and Goldstein's "Modern Development in Fluid Dynamics" (Oxford, 1938). It is stated, page 9, "In many viscometers, however, the capillary is connected at both ends to a reservoir and consequently discharge no longer takes place into air. If now the surface area of the two reservoirs is large compared to the capillary diameter, *there cannot be any kinetic energy correction in the true sense of* $\rho Q^2/\pi^2 a^4$" (my italics). Although the author goes on to state that "Nevertheless, experience has shown that such a correction is necessary," it should be pointed out that the kinetic energy correction ($m\rho Q^2/\pi^2 a^4$) is quite independent of the type of exit obtaining. It measures the head or potential energy lost at the entry due to its conversion into kinetic energy of flow. If the flow is fully turbulent in the tube, m is equal to or exceeds 0·5. If the flow is viscous—*i.e.*, the velocity distribution is parabolic—m must be unity or exceed it by a slight amount. (Goldstein gives a very detailed discussion.) The kinetic energy at the outlet is lost, whether exit is into air or a reservoir of liquid, because the efficient conversion of kinetic energy of flow into a pressure head is exceeding difficult. In viscometers no attempt is made to convert this kinetic energy at the exit into a pressure and, consequently, it is totally lost in so far as the pressure measurement is concerned. Added to these losses are, of course, the Couette losses at the inlet.

A few minor points may be mentioned in connexion with this chapter: On page 17, the words "accuracy" and "precision" are used as synonyms, when only precision is meant. On page 21 reference is made to equation 15 when equation 14 is the one probably intended. Finally, it is stated, page 20, that experimenters often

overlook the necessity for adjusting the filling of a U-tube viscometer when the temperature is raised, which is probably an undeserved reflection on most users of these instruments.

The third chapter deals in a straightforward manner with rotary and oscillatory viscometers. Whilst the author rightly does not go as fully as Barr into the subject, he has added quite a number of viscometers of these types which do not appear in the "Monograph." An important omission is the recent development of recording rotary viscometers, *e.g.*, Wicker and Geddes (*A.S.T.M. Bull.*, 1943, **120**, 11–18).

Chapter IV discusses viscometric methods using falling or rising spheres. In a concise book like this one it would probably be sufficient to give Faxen's corrections for the wall effects, as Ladenberg's method is by now known not to give the correct answers. A point worth mentioning here is that the density of steel spheres should be determined individually as measurable differences can arise, especially with small-diameter spheres.

In the fifth chapter the author deals with technical viscometers. Probably the only correct way of discussing standard technical viscometers is to give the procedures of the standard methods verbatim and discuss them later. For example, when a Redwood viscometer is used at high temperatures, oil is allowed to flow into a flask calibrated at 20° C, but used at the laboratory atmospheric temperatures. To a scientist, this is obviously a wrong procedure, and Dr Merrington recommends that the flask should be insulated. Insulating the flask when oil is tested at, say, 200° F will not, of course, give a true measure of 50 ml, since its calibration is at 20° C, but it is probably a more defensible procedure than using it without insulation. Unfortunately, however, the "viscosity" obtained will not be the standard Redwood viscosity in seconds, because the Institute of Petroleum lays it down in its "Handbook on Standard Methods" that for Redwood No. II "the flask shall not be insulated in any way" and keeps silent about insulation for Redwood No. 1. If it is not, at least, "Redwood Viscosity," then it is nothing worth worrying about.

This chapter gives a fairly complete picture of technical viscometers, although one or two viscometers used for highly specialized purposes are not mentioned—*e.g.*, the Ford Cup and its modifications for "dopes" and the Marsh Funnel for drilling fluids in the petroleum industry.

The viscometry of gases is treated briefly, but fairly completely, in Chapter VI. However, to be able to use a viscometer for measuring the viscosity of a gas under particularly low or high temperatures and pressures, this chapter will be found more of a guide to the literature than as a final source of information.

In the following chapter several methods are discussed under "Miscellaneous Methods." Obviously, it is extremely difficult to include in such a chapter just the methods which will be universally judged to be the most important or to deal with them adequately. The author exercised good judgment in his choice. The only method that, in my view, could be treated more generously because of its importance in high-pressure work is the rolling-sphere method as developed by Hubbard and Brown. These authors have gone fully into the very many factors that affect this method and probably deserve more than the short mention given to their work, especially as the impression left is that their work was not significant because the "constants" of their apparatus were found to vary "indicating that their equation is not strictly true."

In Chapter VIII a very brief discussion is presented on methods particularly adapted for very viscous materials. For using rheometers on semi-solid materials it is difficult to recommend this chapter. This is not because what it says is not valid, but because what it does not say is extremely important. The evaluation of the viscosity of semi-solids without a thorough knowledge of the complexities of stress–strain relationships when strains exceeding a few per cent are recorded is most difficult, if not impossible, and this chapter does not even hint at these difficulties. Probably, the same remarks apply to the final chapter dealing with non-Newtonian systems. It is here that the practical research worker will find it very wise to try a deeper study of the subject than is presented.

The book is recommended for those who want a quick but brief—sometimes superficial—reference to most viscometric methods of recent times. A. H. N.

ABSTRACTS.

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Oilfield Exploration and Exploitation.

Geology.

1098. Fossil Zones of Devonian of Alberta. P. S. Warren. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 564–571.—Devonian strata underlie most of the Great Plains Region of Alberta, being exposed only along the fringes of the Plains area. The exposures have been studied for index fossils, and the following zones are suggested for the Upper Devonian in descending order: (*a*) *Tornoceras*, (*b*) *Cyrtospirifer*, (*c*) *Coral*, (*d*) *Spirifer jasperensis* (divided into two sub-zones), and (*e*) *Stromatoporoid* zone.
E. N. T.

1099. Geology of Rocky Mountain Front Ranges near Bow River, Alberta. L. M. Clark. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 614–633.—The Rocky Mountain ranges near the Bow River, Alberta, are an example of thrust-fault structures. The ranges consist of repeated sequences of Palæozoic structure dipping 40° W. and separated by subsequent valleys eroded in Mesozoic or Upper Palæozoic beds. Cambrian to Upper Cretaceous strata are exposed.

In the area discussed in this paper, in which three fault blocks repeat most of the Palæozoic section, the eastern boundary is a major thrust fault, which marks the boundary between the Rocky Mountains and the Foothill belt.

Middle Cambrian strata along the mountain front are overlain unconformably by the Ghost River formation of questionable Devonian age, which itself is overlain conformably by Upper Devonian dolomites and limestones, followed by Lower, Middle, and Upper Mississippian shales and limestones, Pennsylvanian quartzitic and dolomitic sandstones, Permian chert and quartzite Triassic shaly siltstone, Jurassic black shale, and Lower Cretaceous or Jurassic sandstones, shales, and coal. No igneous rocks are exposed.
E. N. T.

1100. Jurassic Sections in Foothills of Alberta and Northeastern British Columbia. J. Spivak. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 533–546.—A number of Jurassic stratigraphic sections along the foothills belt of Alberta and British Columbia are presented, and the significant variations in Jurassic stratigraphy and the geological history of the region are briefly discussed.
E. N. T.

1101. Lea Park and Belly River Formations of East-Central Alberta. E. W. Shaw and S. R. L. Harding. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 487–499.—In 1945 the Alberta Society of Petroleum Geologists agreed to undertake the preparation of a symposium of papers on the stratigraphy of the Alberta basin, as a follow-up to the symposium on Alberta stratigraphy prepared by the Society and published by the Association in 1932. A symposium committee of four was appointed, who planned to have all the papers published in one Association-sponsored book. However, due to the delays in the completion of some of the papers, it has been decided to publish those papers which have been completed and to attempt to secure the others for later publication. This paper forms part of the symposium.

The transition of Upper Cretaceous Montanan deposits from continental beds in the west to marine beds in the east of Alberta has presented difficulties in surface and subsurface mapping. Recent petroleum-exploration activity has resulted in much new subsurface information. This paper describes and illustrates with a map and three cross-sections these relationships for the Lea Park and Belly River formations; the younger Bearpaw and Edmonton formations are also discussed.

The interfingering of the Lea Park formation with the predominantly non-marine Belly River formation makes possible the recognition of ten members which have been previously described. Most of these have been given more than one name because of

uncertainties in correlation. The present study has made sufficiently accurate correlations in east-central Alberta to justify discarding several local formation and member names. The correlations are based on lithologic, microfaunal, and electric-log data. E. N. T.

1102. Leduc Oil Field, Alberta, A Devonian Coral-Reef Discovery. D. B. Laver *et al.*, Imperial Oil Ltd. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 572–602.—The discovery well of the Leduc oilfield, completed in February 1947, was located on the basis of seismic work. By February 1, 1948, 37 flowing wells were producing 4470 b.d. under government allowables. The extent of the field has not yet been defined, but a probable area of at least 8100 acres, with an estimated recoverable reserve well in excess of 100 million brl, is indicated.

Most of the area is covered with glacial drift. In the section drilled to date only the Cretaceous and Devonian systems are represented.

The main producing zones are Upper Devonian dolomites called the D-2 and D-3 zones. These occur at depths of 4850–5400 ft. The D-3 zone appears to be a coral reef. The D-2 zone is rich in coralline material, but is a blanket-type deposit. The oil accumulation appears to be due to both stratigraphic- and structural-trap conditions. Development is proceeding rapidly. E. N. T.

1103. Marine Jurassic Formations of Southern Alberta Plains. J. D. Weir. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 547–563.—The Jurassic sediments of the southern Alberta plains are described from subsurface data. The subdivision of the Ellis group into Swift, Rierdon, and Sawtooth formations, which has been established in Montana, is applicable in Alberta. A major unconformity between the Jurassic and the Palæozoic limestone influences the distribution of the Sawtooth formation, and truncation of the Jurassic formations from south to north has determined the present extent of these formations. E. N. T.

1104. Oldman and Foremost Formations of Southern Alberta. M. B. B. Crockford. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 500–510.—The Oldman formation of south Alberta is a continental deposit consisting essentially of grey sandstones and shales. The Foremost formation underlies the Oldman conformably and is brackish-water in origin, being composed of sandstones, silts, darker shales, and coal seams. Marine phases occur in the Foremost, and brackish-water phases in the Oldman. Thickness of the combined formations varies from 1600 to 600 ft. E. N. T.

1105. Pre-Waterways Paleozoic Stratigraphy of Alberta Plains. J. R. McGehee. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 603–613.—Sample determinations from twelve wells show a sequence of strata of questionable age referred to as the Elk Point formation, which underlies a thick section of Upper Devonian strata and lies upon Ordovician, Cambrian, or pre-Cambrian rocks. The maximum thickness of the formation of red shales, anhydritic dolomites, and argillaceous silty limestones—is 1557 ft, and its age is believed Silurian. However, recent evidence suggests at least the upper part of the formation may be Middle Devonian. E. N. T.

1106. Upper Cretaceous in Western Peace River Plains, Alberta. Joseph Gleddie. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 511–532.—The area described includes approximately 3600 sq. miles of plains area in north-central Alberta. The strata here comprise 2000–3000 ft of Upper Cretaceous formations including, in ascending order, the Dunvegan, Kaskapau, Cardium (Bad Heart), Wapiabi, and Basal Member A of the Wapiti. The name Smoky River formation is now thought to include the Kaskapau, Cardium, and Wapiabi formations. The detailed stratigraphy of the area is described and discussed. E. N. T.

Geophysics and Geochemical Prospecting.

1107. Earth Penetration by Radio Waves. Anon. *World Petrol.*, Mar. 1949, **20** (3), 62.—It has been demonstrated, by setting up receivers in a remote salt-mine working, that radio waves can travel through the earth. This is expected to have important applications in geophysical prospecting. C. G. W.

1108. Exploration with Radio Waves. W. M. Barret. *World Petrol.*, Apr. 1949, **20** (4), 52.—A method of applying radio waves to seismic exploration is outlined. The waves are directed along the air–earth boundary, refracted into the earth, and any wave reflections picked up at the surface. C. G. W.

1109. Seismic Exploration with Surface Shots. W. O. Novelly. *World Petrol.*, Mar. 1949, **20** (3), 56.—Application of the Poulter method of firing surface shots for geophysical exploration is discussed. C. G. W.

1110. Offshore Seismic Exploration in Gulf. V. W. Teufel. *Petrol. Engr*, Apr. 1949, **21** (4), B-7.—Seismic exploration in the Gulf is described. Craft used are converted air–sea rescue boats. Shoran and radar are the surveying methods employed. Radiotelephone contact enables operations to be synchronized accurately. Other aspects of operations are discussed. C. G. W.

Drilling.

1111. Drilling Problems of Abnormal Pressures and Lost Circulation. P. E. Chaney. *Oil Gas J.*, 21.4.49, **47** (51), 210.—Abnormal pressures and lost circulation create serious drilling problems in the Gulf Coast area.

Abnormal pressure is defined as a pressure in excess of the hydrostatic head of a volume of salt water from sea-level, *i.e.*, 0·465 p.s.i. per ft depth.

The author postulates that abnormal pressures occur in isolated or sealed reservoirs by degradation of high molecular weight organic materials.

Lost circulation when associated with abnormal pressures is more usually due to failure of the formation than to the presence of cavernous or porous formations. The only effective measure in such cases is to operate with low mud pressures.

References are appended. C. G. W.

1112. A New British Bit. Anon. *Petrol. Times*, 8.4.49, **53**, 249.—A bit has been made of solid structure with no moving parts. The bit body is of high-tensile steel. Cutters of high-tensile steel are welded into the body and a heavy deposit of carbometal applied. Carbometal is a combination of tungsten carbide with other alloys, and is tough enough to withstand the shocks encountered in drilling. C. G. W.

1113. Simplified Calculations for Combination Casing Strings. Anon. *World Oil*, Jan. 1949, **128** (9), 87.—A method of calculating casing strings when collapse resistance is a factor is presented. Results are obtained by means of a formula and a table of parameters.

Minimum allowable length such that the minimum collapse resistance will support the prevailing collapse pressure at a depth of $(L - x)$ is given by

$$x = \frac{L}{a} + \frac{n}{b} - c\sqrt{1 - \frac{(L+n)^2}{d}}$$

where L = depth to bottom of section

$n = \frac{W}{w}$ = ratio of total hanging load below the section to weight per unit length in the section.

The parameters a, b, c, and d are functions of ratio evaluated by simple formulæ, and are tabulated for various weights of casing. C. G. W.

1114. Causes and Prevention of Drill Pipe and Tool-Joint Trouble 4. H. G. Texter and R. S. Grant. *World Oil*, Jan. 1949, **128** (9), 90.—Failures may be due to old or worn drill pipe and to the use of crooked pipe. Collapsed pipe is usually old pipe run on drill-stem tests or accidentally run empty. Cases of collapsed new drill pipe are rare. It is concluded that eccentric wall pipe, internal erosion, and magnetism have no effect on service life of pipe.

A summary of the series of articles is given. References and discussion are appended. C. G. W.

1115. **Drilling Through Cavernous Formations.** D. H. Stormont. *Oil Gas J.*, 7.4.49, **47** (49), 66.—On encountering large caverns in the Fusselman zone in the Dollarhide field of West Texas, fillers and solids did not restore circulation. "Dry" or lost circulation drilling was used to drill to a depth where casing could be set. A general description of the field is given. C. G. W.

1116. **Diesel Electric Barge Rig on Lake Maracaibo.** E. H. Lamberger. *Petrol. Engr*, Apr. 1949, **21** (4), B-38.—A detailed description of a barge rig, designed for drilling to 15,000 ft in water depths up to 110 ft, is given. C. G. W.

1117. **Mechanics of Drill Stem Testing. Part 2.** R. E. Edwards. *World Oil*, Jan. 1949, **128** (9), 82.—In drill-stem testing the pressure record shows: (1) increasing hydrostatic pressure of drilling fluid while tester is being run in; (2) change in pressure on opening tester valve; (3) pressure changes due to flow through tester; (4) rate of build-up of natural bottom-hole pressure; (5) decreasing hydrostatic pressure while pulling out. Characteristics of these effects are shown by example. Practices used to avoid damaging pressure gauges and collapse of pipe are described. Causes of stuck drill stem and of blow-outs during test are discussed. References are appended. C. G. W.

1118. **Interpretation of Core Analysis Results.** W. M. Edinger. *Oil Gas J.*, 31.3.49, **47** (48), 104.—The author deals with interpretation of core analyses when coring with oil or oil-base mud. The applications of oil coring are discussed.

It is concluded that when circulating with oil of substantially lower gravity than the produced oil, connate water, reserves, production mechanism, etc., can be simply and accurately determined. C. G. W.

1119. **New Drilling Rig.** R. F. Carlson. *Oil Gas J.*, 14.4.49, **47** (50), 78.—This new rig of the Carter Oil Co. has several points of interest. A complete compact mud system makes mud treatment more economical and gives better mud control.

A centrifugal de-sander augments the clearing screens.

The mud system is fully described, and other points of interest noted. C. G. W.

1120. **Submersible Drilling Barge.** L. S. McCaslin, Jr. *Oil Gas J.*, 31.3.49, **47** (48), 84.—A new drilling barge designed for offshore drilling to 15,000 ft, commissioned by Gulf Oil Corporation, is described. C. G. W.

1121. **Design of Wells to Supply Salt to Chemical Plants.** C. A. Butler, Jr. *Petrol. Engr*, Mar. 1949, **21** (3), B-40.—Problems in drilling, operating, and maintaining salt wells are similar to those encountered in oil wells making salt water. Method of production is to inject water into the salt bed and remove brine.

Some salt-well practices are described. C. G. W.

Production.

1122. **Practical use of Bottom-Hole-Pressure Build-up Curves.** J. J. Arps and A. E. Smith. *Oil Gas J.*, 28.4.49, **47** (52), 91.—When a producing well is shut in, the pressure in the well bore will build up till the static bottom-hole pressure is reached. The characteristics of the curve and the value of the static bottom-hole pressure are essential to efficient reservoir engineering. To eliminate the time wait necessary to reach equilibrium, methods have been proposed for extrapolating to static pressure. Such methods are outlined.

Methods of measuring rate of pressure build up are described.

References are appended. C. G. W.

1123. **Oxygen Concentration Effect on Flood Water From Pick-up.** H. A. Stoltenberg, *World Oil*, Jan. 1949, **128** (9), 154.—Tests carried out in three different waters indicate that ion pick-up is most severe at high oxygen concentrations. The tests are described. C. G. W.

1124. Nomograph Calculates P–V–T Relations of all Perfect Gases. G. E. Mapstone. *Chem. Engng*, 1949, **56** (3), 142.—Solution of the adiabatic gas equations can be handled conveniently with the nomograph shown. Numerical examples are worked out using the nomograph involving the equations :—

$$P_1V_1^k = C_1 = P_2V_2^k$$
$$T_1V_1^{(k-1)} = C_2 = T_2V_2^{(k-1)}$$
$$T_1P_1^{\left(\frac{k-1}{k}\right)} = C_3 = T_2P_1^{\left(\frac{k-1}{k}\right)}.$$

R. G. T.

1125. Permeability Trends from Reverse Circulation Bit Cuttings. N. P. Whaley. *World Oil*, Jan. 1949, **128** (9), 121.—Porosity of formations may be determined from the grain volume and bulk volumes of bit cuttings obtained by reverse circulation. Permeabilities can then be determined if a correlation between porosity and permeability is available for the formation.

The value of such " chip coring " in drilling operations is emphasized. It is believed that with careful technique in coring and laboratory testing, results will be at least as accurate and in some cases more accurate than conventional plug coring.

C. G. W.

1126. Plastic Squeeze Jobs. L. L. Terry. *World Oil*, Jan. 1949, **128** (9), 140.—Formation conditions leading to cement channelling in Kansas made water shut-offs an expensive operation. Squeezing with plastic was found to be effective in shutting off water. Advantages of plastic are : (1) low cost ; (2) less waiting time ; (3) less pressure ; (4) permanence. It is emphasized that for successful operations full consideration of engineering data is essential. The formation conditions causing channelling are discussed, and the methods of plastic squeezing described. C. G. W.

1127. Salt Water Disposal. J. R. Hatfield and L. B. Hicks. *Oil Gas J.*, 14.4.49, **47** (50), 113.—Kansas practices in reinjecting produced salt water as a method of disposal, are described. C. G. W.

1128. Application of Secondary Recovery Methods. J. P. Wible. *World Oil*, Jan. 1949, **128** (9), 144.—In secondary recovery operations three factors must be considered. (1) The volume of residual oil in the reservoir ; (2) characteristics of the producing sand and proportion of recoverable oil ; (3) economic considerations.

The influence of these factors on the operation of the field as an economic unit is discussed. C. G. W.

1129. Prediction of Secondary Recovery from Core Analysis. R. C. Earlougher and J. M. Robinson. *Oil Gas J.*, 31.3.49, **47** (48), 111.—Information required for prediction of secondary recovery includes : (1) net sand thickness ; (2) oil content ; (3) per cent porosity ; (4) per cent oil and water saturations ; (5) permeability ; (6) laboratory flooding tests ; (7) net floodable sand thickness. The application of this data to secondary recovery is discussed. References are appended. C. G. W.

1130. Treating E. Texas Oilfield Water. R. H. Zufeldt. *Petrol. Engr*, Mar. 1949, **21**, (3), B-7.—Water for water-injection purposes must be treated to avoid plugging of formations. Conditioning methods include : (1) closed system, *i.e.*, maintain water in equilibrium so that no precipitation occurs ; (2) open–closed system ; (3) open system.

The open system include aeration and chemical treatment, and potassium permanganate treatment. These two methods are dealt with fully, and the economics of each discussed. It is concluded that the permanganate is more economical, safe, and simple than other chemical treatments. C. G. W.

Oilfield Development.

1131. Shell Oil's New Field Laboratory Expedites Development Program. D. H. Stormont. *Oil Gas J.*, 21.4.49, **47** (51), 192.—Several photographs are shown of the

Shell Trailer laboratory and its equipment. Three of these field laboratories are now in use at Odessa, Texas, and in the New Orleans and Houston fields. The work carried out by the Odessa unit personnel is briefly described. Its day-to-day study of drill cores and drill cuttings provides immediate information to the engineers as to the position to test or complete wells, aids his knowledge of reservoir behaviour, and contributes towards his long-range objective of increasing ultimate recovery by pressure maintenance or secondary-recovery methods. Outlines are given of the tests and determinations carried out on core samples and drill-cutting analysis.

Brief details are given of the records kept and related field studies. Two references are given. W. H. C.

Transport and Storage.

1132. Cathodic Protection of Buried Metallic Structures. Anon. *Pipe Line News*, Apr. 1949, **21** (4), 18.—This is the first bulletin of a correlating committee on cathodic protection. It is a statement of the problem and its solution in general terms. C. G. W.

1133. Internal Corrosion of Crude Oil Tanks. R. A. Brannon. *Pipe Line News*, Feb. 1949, **21** (2), 12.—The causes and economics of and remedies for corrosion of crude-oil tanks on pipe-lines are discussed. C. G. W.

1134. Corrosion Problem in Offshore Drilling. A. E. Burns, Jr. *Petrol. Engr*, Apr. 1949, **21** (4), B-86.—Corrosion in offshore structures is exceptionally severe. There are three zones of corrosion on an offshore structure: (1) continuously submerged area; (2) intermittently submerged area; (3) area above high-water level.

Fouling by marine organisms is an important factor, since organic-paint films are rapidly cut through and destroyed.

A coating recommended for submerged and partly submerged areas is Catha-Coat, an entirely inorganic composition with very high zinc content.

Suitable protections for all areas are discussed briefly. C. G. W.

1135. Cost-imating. Centrifugal Pumps. W. L. Nelson. *Oil Gas J.*, 5.5.49, **47** (53), 103.—No. 29 in the series gives a table showing approximate cost indices for years 1926–49 for centrifugal pumps; complete with motors and starter switches.

Another table shows costs of reciprocating steam and rotary pumps and a graph displays dollars per horsepower against driver horsepower. G. A. C.

1136. Cost-imating. Structural Steel Frames. W. L. Nelson. *Oil Gas J.*, 28.4.49, **47** (52), 141.—Means are given in No. 28 of this series, for quick estimation of costs of steel frames for carrying platforms, exchangers, stairs, cranes, etc. Reference is made to Cost-imating No. 18, 17.2.49.

End view of a typical frame is depicted. G. A. C.

1137. Oil Pipe-Line Pumps for Iraq. Anon. *Engineer*, 1949, **187**, 266–269, 295–297.—A description is given of an oil-engine-driven reciprocating pump, one of thirty-six pumps ordered by the Iraq Petroleum Co. for their 12-in pipelines between Haditha and the terminals at Haifa and Tripoli. The pump is of the outside-packed-plunger pattern, 7¾ in plunger by 24 in stroke, and consists of three units powered by a common crankshaft to give a designed output of 1200 g.p.m. at 1000 p.s.i. The pump body and suction valve box are steel forgings with all passages and valve chambers machined from the solid. Mitre-beat wing-guided valves are used, made from stainless-steel drop forgings, and renewable seats are provided. A special alleviator is fitted, with arrangements to prevent contact between air and oil, so that the necessity for frequent air charging is avoided. All moving parts are completely contained in dust-tight enclosures, on account of the severe climatic conditions under which the pumps will operate. Continuity of lubrication is safeguarded by visible and audible alarms. The driving engines are four-stroke diesel units developing 950 b.h.p. at 300 r.p.m. A. C.

1138. Pipe-stress Analysis for Thermal Expansion. S. W. Lewaren. *Oil Gas J.*, 5.5.49, **47** (53), 80.—A simple method for determining thermal stresses in pipeline systems where high temperatures are met is given.

Described as the "elastic centre method," it is convenient for determinations in pipe runs which are of such type that ordinary graphical analysis is not practical.

The method is given step by step. Two examples are stated and solutions given.

G. A. C.

1139. Pressure Surges in Oil Lines. E. T. Skinner. *Pipe Line News*, Jan. 1949, **21** (1), 16.—Pressure surges are shock waves (water hammer) produced by a sudden increase or decrease in fluid velocity. Such waves may cause pressures of more than double the operating pressure. Causes of surging are valve closing; suction-line pressure surge and discharge-line pressure surge are due to valve and piston action. Possible remedies are surge tanks, surge pistons, and by-pass pipes. Wave interference, *i.e.*, arranging a by-pass so that the surges at the junction are 180° out of phase and so cancel, is advocated as a possible remedy. C. G. W.

1140. Applications of PTM Radio Link to Pipe Lines. R. G. Maddox. *Pipe Line News*, Mar. 1949, **21** (3), 13.—The advantages of microwave links applied to communications are outlined. Modes of operation of such systems are described.

C. G. W.

1141. Trends in Tanker Design. W. B. Jupp. *World Petrol.*, 1949, **20** (4), 40–41.—Since 1945 the most noticeable change in tanker design has been from deadweights of 16,000 tons and 4000–6000 h.p. to deadweights of 25,000–30,000 tons and 12,000–20,000 h.p. Large tankers now building are designed for speeds of 15 knots or more, and pumping plants can discharge the ship's cargo in 10–12 hr. Suez Canal and various harbour authorities are studying the question of accommodating these larger vessels. Radar equipment is becoming practically standard, and air conditioning of mess-rooms and accommodations is also being installed. A. C.

1142. Basic Elastic Theory of Vessel Heads Under Internal Pressure. G. W. Watts and W. R. Burrows. *J. appl. Mech.*, 1949, **16** (1), 55–73.—The Love analysis is used to develop methods for calculating internal press stresses and deformations at or near the junctions of semi-infinite cylindrical vessel shells with hemispherical, ellipsoidal, toriconical, torispherical, conical, and flat heads. Dimensionless variables are proposed to define the changes in head shape and the changes in the relative thicknesses of heads and cylinders. Crit. head stresses may be shown by use of these dimensionless variables. The paper is well illustrated, and forty-three references are given.

D. F. J.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1143. Agitated Gas Absorbers. K. S. Valentine. *Chem. Engng*, 1948, **55** (12), 117–118.—A description of agitator-type gas absorbers is followed by various applications including hydrogenation. Other applications are briefly mentioned. R. G. T.

1144. Nomographs Speed Flow Calculation. J. F. Heiss and J. Coull. *Chem. Engng*, 1949, **56** (4), 104–107.—Three charts are presented to facilitate determination of flow rate or time of discharge from a tank through a pipe. Theoretical principles are developed from Bernoulli's theorem. Specific illustrations are included for constant-head tanks and for varying depth problems. R. G. T.

1145. Study of the Supersonic Axial-Flow Compressor. W. A. Loeb. *J. appl. Mech.*, 1949, **16** (1), 19–26.—As idealized conditions are assumed, the results of this study cannot be used as design criteria. However, certain qualitative conclusions can be drawn. These are: (*a*) good press ratios with high efficiencies may be obtained; (*b*) a compressor having a normal shock wave in the stator is superior to one having a

normal shock wave in the rotor; and (*c*) the largest restriction on this normal shock in-stator compressor is the Mach No. limitation in the rotor. D. F. J.

1146. Flow Through a Pipe with a Porous Wall. F. C. W. Olson. *J. appl. Mech.*, 1949, **16** (1), 53–54.—Relations between fluid flow and press drops are determined for laminar flow through a pipe with a porous wall. A solution for the flow is obtained in such a form that numerical results can be readily obtained from existing tables. D. F. J.

1147. The Manifold Problem. J. D. Keller. *J. appl. Mech.*, 1949, **16** (1), 77–85.—Solutions have been developed for fluid flow in manifolds which supply fluids to a set of parallel pipes, or which discharge fluids through openings along the manifold length. These solutions are presented in a form which is of use to designers. Examples which are considered include the pipe-burner for gaseous fuels, manifolds for certain types of multi-tube air heaters, and furnace combustion chambers containing head ports. D. F. J.

1148. Mass Transfer in Liquid–Liquid Agitation Systems. A. W. Hixson and M. I. Smith. *Industr. Engng Chem.*, 1949, **41** (5), 973–978.—The quantitative performance of an agitator in a liquid–liquid extraction system has been investigated. An equation is derived relating the wt of solute transferred from one liquid to a second immiscible liquid; the ideal system water–iodine–carbon tetrachloride verifies it. The effects of speed of agitation and vessel size are discussed. R. G. T.

1149. Investigation of the Variation of Point Unit Heat-Transfer Coefficients for Laminar Flow Over an Inclined Flat Plate. R. M. Drake, Jr. *J. appl. Mech.*, 1949, **16** (1), 1–8.—The forced-convection heat-transfer phenomena in the laminar-boundary-layer regions for a non-isothermal inclined flat plate can be correlated and represented by equations of the type

$$\frac{Nu_x}{\sqrt{Re_L}} = C\left(\frac{x}{L}\right)^n,$$

where Nu_x = Nusselt's modulus at point x,
Re_L = Reynolds' modulus for plate,
x = distance along plate from stagnation point, and
L = total length of plate.

This equation is similar in slope to the theoretical equation of the type

$$\frac{Nu_x}{\sqrt{Re_L}} = C_3\left(\frac{x}{L}\right)^{\frac{n+1}{2}}$$

for an isothermal plate in laminar flow, but is larger by 30% in absolute value. D. F. J.

1150. Standard Designs for Pilot Unit Equipment. J. A. Ridgeway, Jr. *Industr. Engng Chem.*, 1949, **41**, 1082–1085.—A few items are discussed for which the need frequently arises in pilot installations and for which designs (experimentally proved effective) are available. Using these designs a measure of standardization of equipment has been attained and found beneficial in expediting pilot research in the author's laboratory. The items discussed are heating and heat-transfer units, sampling and metering devices, and details of reactor design. R. G. T.

1151. Separate Department Handles all Activities Associated with Esso Standard's (Baton Rouge) Stream Pollution-Control Program. G. F. Ullrich. *Oil Gas J.*, 21.4.49, **47** (51), 181.—A new department was instituted at Baton Rouge refinery in 1944 to deal with the control of stream pollution. The problems requiring solution and/or improvement, the chemical and biological investigations made, and underway, improvements in equipment, procedures, and control are discussed.

Automatic pumping facilities were placed in the inlet boxes of separators with continuous-recording meters on the discharge lines.

In the treating plant, separator skimmings are chemically treated, and tank bottoms undergo both thermal and chemical operations. A flow sheet of the treating plant indicates the vessels, auxiliaries, and process. Tank-bottom emulsions are passed to a closed-coil-heated thermal tank in which the separation takes place of :—

(1) clean oil, which flows from the top, for re-running;
(2) water and silt, from the bottom, flow to a settling pond;
(3) emulsion from the centre, which is pumped out and joined by a chemical demulsifying solution, passed through an exchange heater, is injected with soda, and passed via a seven-orifice mixer to the chemical-treating tank.

From the latter the top and bottom layers flow out similarly as (1) and (2). Separator skimmings follow the route (3). Silt-oil bottoms from separators are removed every 4–6 weeks by a mud pump and are sent to the silt-treating unit consisting of three agitators in which water dilution, to a 15 vol % concentration is made. The mixture is gently aerated, settled, and skimmed. The slurry is land dumped and drained. The recovered oil is treated as for skimmings. To avoid the emulsifying effect due to spent caustic, a collective system is used. After settling, the recovered oil is drawn off, and the caustic liquor is used as the demulsifier in the treating plant. The main refinery effluent is tested daily for oil content, pH value, etc. Monthly chemical and biological tests are made, and an aquarium is employed in the studies. Co-operation with the Louisiana Refiners Control Council is discussed. The information gained by the joint collaboration has contributed greatly to the knowledge of the effect of wastes on aquatic life in the local waters. W. H. C.

1152. Cost-imating. Tubes and Bends. No. 27. W. L. Nelson. *Oil Gas J.*, 21.4.49, **47** (51), 243.—The approximate costs, based on 1946 prices in dollars, are given for :—

1. Carbon-steel return bends and elbows 1½ in, increasing by ½–6½ in light and heavy types.
2. Seamless carbon-steel tubing; machining tube ends; small and large gaskets of pure iron, aluminium, and Swedish iron.

The ratio to carbon-steel cost is shown for six types of alloy steel tubes and bends. The approximate centre-to-centre spacing, in inches, is given for heavy and light, box type, and streamline bends from 2 to 6 in by ½ in increments.

A table shows the most economical tube length (in feet) for large and small: straight types; simple down convection; modern down convection and overhead convection—when the heat absorption is 10, 20, 30, 40, and 60 M.M. B.Th.U. per hour. This table indicates clearly why down-convection types of stills are being abandoned.

Alloy-steel tube and bend costs for six different alloys are shown as a ratio to carbon-steel costs. W. H. C.

Distillation.

1153. Extractive Distillation. F. H. Garner. *Industr. Chem.*, 1949, **25**, 238–242.—Extractive dist is a continuous fractionating process in which the relative volatilities of the two components being separated are altered by the introduction near the top of the tower of a higher boiling solvent. The solvent is removed from the bottom of the tower with the heavier component, separated, and recycled. This latter separation may be effected by dist, cooling to form two phases, water washing, or solvent extraction. The solvents normally used for extractive dist are those developed for liquid–liquid extraction processes. Generally the boiling points of the components being separated are $<10°$ C apart. Typical applications of the process are the separation of toluene from associated compounds produced in hydroforming, using phenol as solvent; and separation of butadiene from butanes and butenes using furfural–water or acetone as solvent. The volatility of the solvent is important, since if it is too high there will be too much in the vapour and not enough in the liquid, giving poor selectivity. Experimental methods of determining relative volatilities of the components in the presence of solvents are described.

Some points in design and operating differences between extractive and ordinary fractional dist are as follows: (*a*) since the solvent in extractive dist is relatively non-volatile its concn tends to be const from plate to plate, except above its feed plate in

the upper part of the column; (*b*) plate efficiencies are markedly affected by visc of solvent, *e.g.*, in the separation of butenes from *n*-butane the efficiency is about 25% when furfural is used as solvent and 60% when acetone is used; (*c*) flooding may occur in extractive dist if two liquid phases form; however, it is often advisable to adjust the composition of the solvent mixture to approach phase separation and thus obtain max selectivity; (*d*) the presence of solvent results in relatively large ratios of liquid to vapour, and care must be exercised in design to give min hydraulic gradient across trays; (*e*) controls are usually based on flow rates, since the temp gradients across the tower in extractive dist are often very low. Extractive dist has some marked advantages over azeotropic dist, *e.g.*, a much wider variety of solvents and operating conditions is available, and the heat input is lower, since it is unnecessary to vaporize the solvent. A. C.

1154. Evaluation of Vacuum Rectification Columns (Use of Binary Test Mixtures). J. Feldman, M. Myles, I. Wender, and M. Orchin. *Industr. Engng Chem.*, 1949, **41** (5), 1032–1036.—Operation of fractionating columns at sub-atm pressure was investigated using two binary mixtures: (*a*) *n*-dodecane and *cyclo*hexyl*cyclo*pentane and (*b*) *n*-tridecane and di*cyclo*hexyl. Vapour–liquid equilibria were studied at various compositions and pressures from 20 to 350 mm Hg. Two different types of stills are described. Refractometric analyses were made. Increase of relative volatility at low pressure prevents use of columns of >20-plate efficiencies at 20 mm. Mixture (*a*) was almost ideal. R. G. T.

1155. Simplified Wire Screen Packing for Fractionating Columns. H. J. John and C. E. Remberg. *Industr. Engng Chem.*, 1949, **41** (5), 1056–1058.—An easily fabricated, inexpensive, and efficient screen packing is described. Welding, grinding, precise fitting, and preassembly of parts are eliminated. Ordinary glass or metal tube is sufficiently uniform for use with this packing. Three columns up to 2 in dia were investigated for efficiency, liquid hold-up and press drop. Operation results compare favourably with other screen packings which are more difficult to use. R. G. T.

Absorption and Adsorption.

1156. Carthage Field, Scene of High Gasoline-Plant Expansion. D. H. Stormont. *Oil Gas J.*, 21.4.49, **47** (51), 134.—The Carthage natural-gas field of Panola County, East Texas, covers over 230,000 acres and contains 510 gas and nineteen oil wells. Brief details are given of the formations, the reserves of which are estimated at around 6½ trillion cu. ft. The six gasoline plants in the Carthage field are named, and their individual operating data for February 1949 show that: 17,810,595 million cu. ft. was processed, and gave (in barrels): 54,799, condensate; 27,350, L.P.G.; 3539, propane; 21,796, butane; 260,056, motor fuel; 43,292, kerosine; 2501, other products and 16,483,137 million cu. ft. dry gas was distributed by pipeline. At one plant only (Lone Star Co.) is cycling carried out. The reasons why no other cycling is practised are given. The planned capacity expansion of each of these plants is discussed. By about June this year some 600,000 million cu. ft. daily greater output will bring their total capacity up to 1,030,000 million cu. ft. Four photographs of these plants are given.

A total production of 630,000 million cu. ft./day was attained in December last, and by 1951, or earlier, daily withdrawals of gas are expected to exceed 1,000,000 million cu. ft. W. H. C.

1157. Relationship Between Gasoline Plants and Gas-Repressuring Programs. West Pampa Repressuring Association is an Excellent Example. F. J. Neslage. *Oil Gas J.*, 21.4.49, **47** (51), 138.—The information given is from the author's paper "Gas Injection by West Pampa Repressuring Association's Repressuring Project" read at the A.P.I. Mid-Continent Production District meeting at Tulsa in March 1949. This article describes "the contractual arrangements as between the oil operators in the association and as between the gasoline-plant operators and oil operators." The agreements and articles of organization are enumerated, and the main provisions of the agreement between the oil operators and the two gasoline-plant companies are given. The three clauses of interest are: The gasoline-plant companies are to install

sufficient boosting equipment to furnish an ultimate maximum injection of 30 million cu. ft/day, at a pressure of 450 p.s.i.; to install the field-distribution system, which includes an H_2S treater, a dehydrator, and "all equipment necessary to deliver gas to each quarter section, and to be responsible for its maintenance and upkeep for the life of the project"; supply repressure gas containing less than 1% oxygen, less than 1 grain per 100 cu. ft. of H_2S and dehydrated sufficiently to prevent freezing under operating conditions. Field-personnel training is outlined. Charts show: (1) increased gasoline–butane–propane production due to repressure; (2) gas-injection data, for the years 1946–48. W. H. C.

1158. Performance and Efficiencies of a Gas Cycling Operation. R. L. Hock. (*Taken from a paper read at 28th convention of N.G.A.A. Fort Worth*, April 1949.) *Oil Gas. J.*, 21.4.49, **47** (51), 140.—The underground formations of the Cotton Valley, Louisiana field are briefly noted. Since 1937 six gas-condensate reservoirs have been proved in an area of *ca* 18,295 acres, and 139 wells have been drilled. The Cotton Valley Operators Committee, formed in 1940, started a unitization and pressure-maintenance programme, and at present two of the reservoirs are being cycled, and a third is under trial cycling. The technology of cycling is based on the behaviour of hydrocarbon mixtures in the retrograde condensation-pressure range. Tests allow the prediction of the influence of a pressure decline upon the liquefiable gas content of the issuing mixtures. Graphical data of the results of cycling are given for the Bodcaw sand reservoir. Discussion of this data covers the volumes produced, the initial pressure, and its decrease by 1949 when the wet gas contained 72 brl butanes and higher per million cu. ft. Of the initial 57 million brl, 1 million brl was lost prior to cycling commencement, and later 11 million brl was lost owing to not repressuring to original level (4000 p.s.i.). The gain by cycling is shown to be 7 million brl. The savings realized by cycling are given in volumes and dollars. Another checking method is illustrated by a graph of the cycling efficiency of the same reservoir, and is extensively discussed. It shows that 80% of the initial gas volume will be produced during the economic period of cycling. Change in gravity of the wet gas as dry gas is returned to the formation is shown in a graph. W. H. C.

1159. Light Hydrocarbons at Peak. Texas, Louisiana Account for 76·4% of Gain. J. C. Casper. *Oil Gas J.*, 21.4.49, **47** (51), 136.—The reserves of natural gas liquids for Texas, California, Louisiana, Oklahoma, Kansas, and "other" states are recorded, they amount to a total of 3,540,783,000 brl. The daily plant production of light hydrocarbons for each of fourteen states for January 1949 and the increases over those of January 1948 and 1941 are tabulated. The total production for January 1949 was 17,595,000 b.d., and the increase was 1,341,000 and 9,092,000 respectively. Production of natural gasoline, L.P.G. and other products of natural gasoline and cycling plants is shown for each year from 1941 to 1948, expressed as per cent of total production. The amounts and increase of natural gasoline and light products used by refineries in each of twelve districts relative to 1947 and 1948 are shown together with the "Districts' per cent of increase," and "Districts' per cent of crude runs." The total used for 1947 was 193,678 b.d., and for 1948, 208,297 b.d. The data are discussed as to states where recent expansions in plant capacity have influenced current production, and it is shown that the relative ability of a district to use additional quantities of natural gasoline depends upon the amount of petroleum refining in the district. The effect of a slight drop in refinery use of natural gasoline on market price is shown. W. H. C.

1160. Hypersorption. C. Berg, R. G. Fairfield, D. H. Imhoff, and H. J. Hulter. *Oil Gas J.*, 28.4.49, **47** (52), 95.—The hypersorption process for separation and recovery of light gases employs a moving bed of activated carbon to absorb the hydrocarbons out of lean-gas streams at low pressure.

General construction of a typical unit resembles that of a fractionating tower with the additional equipment to effect transfer of solids from bottom to top, and to provide storage.

Attrition losses in circulation of activated carbon are very low, and there is virtually no deterioration in activity of the carbon.

A commercial plant at Midland, Mich., recovers ethylene normally lost in the

demethanizer column overhead stream in a low-temperature fractionating unit; 1,800,000 cu ft. per day of gas at 75 p.s.i. being processed, a carbon circulation of 18,000 lb per hour being employed. Carbon-stripping temperature of 500° F is used, and 98% of ethylene in the feed stream is recovered.

Hypersorption recovers propane and butane from natural gas.

The purification of hydrocarbon-synthesis gases, recovery of acetylene from oxidation gases, and purification of hydrogenation gases are among applications of the process.

Eleven tables and four figures, including a flow sheet, are given. G. A. C.

1161. A New Way to Stock-pile Natural Gas. C. V. Spangler. *Oil Gas J.*, 5.5.49, **47** (53), 94.—A method involving the use of a solid adsorbent, fuller's earth, for the storage of natural gas is described. The gas is circulated by a compressor through a chilling device and then through a large bed of the adsorbent material. The stored solid fuller's earth would be arranged in a container. It is considered that the solid methane–adsorbent combination is much safer to store than methane liquid or vapour.

The adsorbents could also be used for separation of nitrogen from natural gas.
G. A. C.

Hydrogenation.

1162. Hydrogenation of Coal in Batch Autoclaves with Coke-Oven Gas. S. Weller, M. G. Pelipetz, M. Kuhn, S. Friedman, and E. L. Clark. *Industr. Engng Chem.* 1949, **41** (5), 972–973.—Investigation of use of coke-oven gas to produce liquid fuels from coal has been made in small-scale batch autoclave experiments. The hydrogenation is satisfactory, but not as good as with pure H_2, at the same partial pressure of H_2. Ethylene in the gas is reduced to ethane, CO undergoes the water–gas shift. At H_2 pressures below 1000 p.s.i., temp increase from 450 to 456° C decreases liquefaction and increases gasification. R. G. T.

1163. Stripping of Coal-Hydrogenation Heavy Oil Slurry. T. R. Savich, M. G. Pelipetz, W. A. Budy, E. L. Clark, and H. H. Storch. *Industr. Engng Chem.*, 1949, **41** (5), 968–971.—Continuous treatment of heavy oil let-down, the solids-containing product from the high-pressure hydrogenation of coal, with superheated steam is described. Evaluation is made of the effects of steam temp (350–600° C) and separator temp (250–400° C) on the yield and composition of the heavy oil let-down (oil, asphalt, and benzene insolubles) in the overheads and residue. The results justify use of high-temp steam with short contact times for solids separation. Solubility of products in *n*-hexane and benzene is discussed. R. G. T.

1164. Liquid Fuel from Coal. M. L. Kastens, L. L. Hirst, and C. C. Chaffee. *Industr. Engng Chem.*, 1949, **41** (5), 870–885.—A survey of recent history of Fischer–Tropsch and hydrogenation processes is followed by an account of a demonstration coal-hydrogenation plant. A detailed description with flow sheet is supplied. Separation of oil from solids in the heavy-oil let-down step is crit in the economy and is extensively discussed. Hydrogen generation is from natural gas by cracking with steam over a nickel catalyst. The catalyst will be a complex mixture of zinc, chromium, molybdenum, sulphur compounds, and fuller's earth. Operating conditions are tabulated, and materials of construction for the various items in the plant are discussed. Instrumentation is comprehensive and complex, operating personnel are listed, and an account of initial start-up difficulties is given. . Design improvements and future developments are suggested. By-product production and the production of heavy fuel oil to replace residual oils are dealt with. Various factors to be considered in the design of a commercial hydrogenation plant are suggested by the demonstration operation. Several modifications are suggested. R. G. T.

Special Processes.

1165. Catalytic Aromatization of Paraffinic Base Gasolines. E. Blasco, J. Doblas, and L. Yzu. *Combustibles (Zaragoza)*, 1949, **8**, 62–66.—A S.R. gasoline containing 93% paraffins and 7% naphthenes was transformed into 100% aromatics with 62% yield of liquid products by passing at 550° C and atm pressure over a chromium oxide on

silica gel cat. At 500° C the yield was 81% and the aromatic content of the product 37%. The present series of experiments is compared with a previous communication, in which the results were described of similar work based on gasoline from a Spanish shale. This gasoline had given poorer results on account of its high initial olefin content. A. C.

1166. Low Temperature Carbonization of Alberta Sub-bituminous Coal (Results of Preliminary Tests of the New Stansfield Retort). J. Gregory and A. McCulloch. *Industr. Engng Chem.*, 1949, **41** (5), 1003–1011.—Construction and operation is described of the new Stansfield retort for low-temp carbonization of Alberta sub-bituminous coal. Operation is based on the yields and composition of low-temp carbonization products of this coal as shown by step-wise carbonization, in stages of 100° C between 320 and 610° C in a Gray–King low-temp assay. Pilot-plant details are included. Product yields and compositions obtained under various conditions are given. R. G. T.

1167. Organics from Natural Gas. J. V. Hightower. *Chem. Engng*, 1948, **56** (1), 92–94, 132–135.—Natural gas is oxidized to produce methanol, formaldehyde, and acetaldehyde. Other petrochemical products are prophesied, *e.g.*, ethylene and aromatics. Oxygen is produced by liquefaction. Product recovery is conventional. Formaldehyde is mainly produced by oxidation of the methanol rather than by direct oxidation. Plant details and a pictured flow sheet are included. R. G. T.

1168. New California Plant Makes Sulfur from Refinery Gas. Anon. *Oil Gas J.*, 21.4.49, **47** (51), 241.—Brief details are given of the sulphur-recovery plant of the Hancock Chemical Co. Los Angeles, built by E. B. Badger and Sons Co., after collaborative design by the two companies, at a cost of $1,800,000. The present capacity is 50 tons/day, and may be doubled in the near future. A flow-sheet illustrates the layout and flow routes. Raw material from the Richfield Oil Co.'s refinery, and later from two other nearby refineries, is received in the form of an H_2S–ethanolamine solution which after exchange heating is stripped in a 16-tray, 50-ft column at 10–20 p.s.i. The tower-bottom liquid is circulated through the rebolier at 300° F. H_2S from overhead passes via condensers to a reflux drum, and the condensate therefrom is further stripped in a smaller tower. The amine-free H_2S flows to a knock-out drum, where pressure is adjusted to 5–12 p.s.i., and thereafter is joined by an air-stream and then undergoes partial combustion in a burner-waste-heat chamber at 3–5 p.s.i. A small amount of sulphur is cyclone removed before the reaction gases pass to an auxiliary burning chamber. Final conversion of the stream is accomplished in a catalyst-filled converter at 2–4 p.s.i., the products being molten sulphur and water vapour. The latter flows off together with any unused H_2S and SO_2, which then pass on via a second cyclone, auxiliary burner, and converter unit, and thence to a scrubber which removes final particles of sulphur. Liquid sulphur flows from the bottoms of the two converters to a receiver from which it is shipped to local acid plants. W. H. C.

Metering and Control.

1169. How Exact is Gas Metering. F. K. Beach. *Petrol. Engr*, Mar. 1949, **21** (3), B-54.—American Gas Association practices in installing, maintaining, and operating gas-meter installations are described. C. G. W.

PRODUCTS.

Chemistry and Physics.

1170. Chemical Reaction During Adiabatic Flow Through a Rocket Nozzle. D. Altman and S. S. Penner. *J. Chem. Phys.*, 1949, **17**, 56–61.—An analysis has been carried out for isentropic expansion through a representative rocket nozzle. It is shown that the temp changes so rapidly that the reaction $2NO \rightleftharpoons O_2 + N_2$ produces insignificantly small composition changes below about 2800° K when the temp in the rocket chamber is 3000° K. W. E. M.

1171. Superficial Density of Matter at a Liquid–Vapour Boundary. R. C. Tolman. *J. Chem. Phys.*, 1949, **17**, 118–127.—The distribution of matter within the transition layer between the two phases of a fluid system is considered. Approx val are obtained for the superficial density of matter T, calc with reference to the Gibbs surface of tension as the dividing surface between the phases. T is defined by the equation :

$$d\delta = -Td\mu,$$

where δ is the surface tension of the boundary and μ is the Gibbs potential for the fluid. W. E. M.

1172. Activity Coefficient Correction Factor Nomograph. E. G. Scheibel. *Industr. Engng Chem.*, 1949, **41** (5), 1076–1079.—The nomograph presented combines all the empirical equations for correction of calc activity coeff showing the deviation from the gas laws and the liquid pressure. The chart depends on the reduced temp and crit. press. of the pure component and eliminates the use of all other equations and charts used for the correction factor. The crit. consts can be correlated from previous correlations, and a simple nomograph for using such a correlation is included on the original chart. R. G. T.

1173. Infra-Red Spectra of C_2H_4. L. G. Smith. *J. Chem. Phys.*, 1949, **17**, 139–167.—The infra-red spectrum of C_2H_4 gas has been studied in the region 1·6–13μ with a spectrometer of high resolving power. From measurements on four resolved parallel bands the value $I_{B_0} = (42{\cdot}234 \pm 0{\cdot}001) \times 10^{-40}$ g/cm^2 has been obtained for the large moment of inertia in the ground state. From measurements on the three fundamental perpendicular bands the best value for the small moment of inertia is $I_A = 10{\cdot}81 \times 10^{-40}$ g/cm^2. Because of uncertainties concerning the perturbations of degenerate state ν_4 this value is provisional. Other conclusions are as follows: 1. Assuming C—C = 1·55 A. then C—H = 1·098 A. and HĈC = 109° 3′. 2. The configuration of C_2H_4 is staggered (point group D3d.). 3. $\nu_8 = 1472{\cdot}2$ cm^{-1}. 4. The torsion frequency $\nu_4 = 290$ cm^{-1}. 5. The "uncertain" frequency $\nu_{12} = 1190$ cm^{-1}. W. E. M.

1174. Effect of Droplet Size on Surface Tension. R. C. Tolman. *J. Chem. Phys.*, 1949, **17**, 333–337.—The effect of droplet size on surface tension is given theoretical consideration with the help of the Gibbs thermodynamic theory of capillarity and of previous results of the author as to the size and magnitude of superficial densities. It is concluded that over a wide range, the surface tension decreases with decrease in droplet size, the effect becoming particularly significant for very small drops. W. E. M.

1175. Hydrodynamic Theory of the Cone of Stationary Flames. T. Westerdijk. *Rev. Inst. franç. Pétrole*, 1949, **4**, 75–79.—A mathematical treatment of the phenomena in the primary cone of a Bunsen flame, based on the conception that the reaction in the flame cone is a discontinuous process. V. B.

1176. Thermodynamics of High Polymer Solutions. IV. Phase Equilibria in the Ternary System: Polymer–Liquid 1–Liquid 2. R. L. Scott. *J. Chem. Phys.*, 1949, **17**, 268–279.—Two approx methods of calc equilibrium phase diagrams have been compared with exact phase diagrams. Both the "single-liquid approximation," and the "complete-immiscibility approximation" give only qualitative results. Analytical expressions for the plait points have been derived. It is concluded that a polymer may be completely soluble in certain mixtures of non-solvents if its internal pressure lies between those of the two liquids and if the two liquids are themselves completely miscible. The position of the phase boundaries is nearly independent of the mol. wt. of the polymer for mol. wt. of above 10,000. It is confirmed that at the crit. solubility limit the osmotic pressure is zero. W. E. M.

1177. Thermodynamics of High Polymer Solutions. V. Phase Equilibria in the Ternary System: Polymer 1–Polymer 2–Solvent. R. L. Scott. *J. Chem. Phys.*, 1949, **17**, 279–284.—It is shown that two high polymers will always be immiscible unless

their heat of mixing is zero or negative, and that the primary role of the solvent is merely one of dilution, thereby decreasing the heat of interaction of the polymers.
W. E. M.

1178. Vibration–Rotation Mechanics of the Allene Molecule. Part 1. Classical Vibration Problem. R. C. Herman and W. H. Shaffer. *J. Chem. Phys.*, 1949, **17**, 30–40.—Symmetry co-ordinates are set up from the standpoint of group theory for describing the normal modes of oscillation of the allene molecular model in such a manner that max factorization of the secular determinant is accomplished. The cubic and quartic portions of the anharmonic potential function are derived, and the components of vibrational angular momentum are set down. The complete valence-type potential function is discussed. Explicit relations are derived between the force constants occurring in the secular determinant and the physical valence-force constants.
W. E. M.

1179. Burning Velocities of Butadiene-1 : 3 with Nitrogen–Oxygen and Helium–Oxygen Mixtures. E. J. Badin, J. G. Stuart, and R. N. Pease. *J. Chem. Phys.*, 1949, **17**, 314–316.—According to Tanford's theory of burning velocity, the substitution of helium for the nitrogen of air should increase the burning velocity because : (*a*) a higher temp will be attained, and (*b*) a higher diffusion coeff will result. Burning velocities of nitrogen–oxygen–butadiene-1 : 3 have been measured at atm and reduced pressures. At atm pressure the ratio of 3·7 : 1 for the max burning velocities was obtained for helium compared to nitrogen as the inert gas. Reduction of pressure caused an increase then a decrease in burning velocity for helium–oxygen–butadiene-1 : 3—the max val occurring at 300 mm pressure. Assuming that the controlling factor in the burning velocity is the back-diffusion of H-atoms, good agreement between calc and experimental burning velocity ratios is obtained. W. E. M.

1180. Entropy and Heat of Formation of Hydrocarbon Vapours. M. Souders, Jr., C. S. Matthews, and C. O. Hurd. *Industr. Engng Chem.*, 1949, **41** (5), 1048–1055.—A convenient method has been developed for the prediction of reliable values of heat of formation and entropy of formation of hydrocarbons. Values for the several groups necessary to the prediction of these thermodynamic properties up to 2000° K are tabulated. Standard state entropies as predicted by the method are believed to be within $\pm 1{\cdot}0$ entropy unit of the correct value. Heats of formation in standard state are within $\pm 0{\cdot}5$ k.cal per mol. Variation with temp of these functions is believed to be accurate to less than 3%. R. G. T.

1181. Prediction of Heat and Free Energies of Organic Compounds. J. L. Franklin. *Industr. Engng Chem.*, 1949, **41** (5), 1070–1076.—Extension of the relations developed by Pitzer for prediction of heat and free-energy content of normal paraffins has been applied to branched paraffins. CH_3, CH_2, CH, and C groups have distinctive values of $(H^\circ - H_0^\circ)/T$ and $-(F^\circ - H_0^\circ)/T$ and these functions are additive properties. Similarly, values for groups can be cal from values for the mols containing them. ΔH° is also an additive function of group constants calc as the above properties. For the majority of typical hydrocarbon groups $(H^\circ - H_0^\circ)$, $(F_0 - H_0^\circ)$, ΔH°, and Δf_f° have been calc. The results enable prediction of hydrocarbon properties to accuracy of 1 k.cal. Applicability to compounds other than hydrocarbons is suggested, but available data is limited. R. G. T.

1182. Relation Between Refraction, Density, and Structure of Series of Homologous Hydrocarbons. G. Smittenberg and D. Mulder. *Rec. Trav. chim. Pays-Bas*, 1948, **67**, 813–838 ; *Rev. Inst. franç. Pétrole*, 1949, **4**, D-36.—A study of the relations between the physical const of hydrocarbons shows that it is possible to express the const of a homologous series by an empirical formula of the type $x = x_\infty + k/(C + z)$ where x is the physical const of the hydrocarbon containing C carbon atoms, x_∞ the limiting value of the const for an infinite No. of carbon atoms, and k and z are const which are characteristic for each series. The following relations were found : for n saturated hydrocarbons $n_D^{20} = 1{\cdot}4752 - 0{\cdot}6838/(C + 0{\cdot}82)$; $d^{20} = 0{\cdot}8513 - 1{\cdot}3100/(C + 0{\cdot}82)$, for n α-olefins $n_D^{20} = 1{\cdot}4752 - 0{\cdot}5610/(C + 0{\cdot}44)$; $d^{20} = 0{\cdot}8513 - 1{\cdot}1465/(C + 0{\cdot}44)$, for *n*-alkyl*cyclo*pentanes $n_D^{20} = 1{\cdot}4752 - 0{\cdot}3920/C$; $d^{20} = 0{\cdot}8513 - 0{\cdot}5984/C$ and

for *n*-alkyl*cyclo*hexanes $n_D^{20} = 1{\cdot}4752 - 0{\cdot}3438/C$; $d^{20} = 0{\cdot}8513 - 0{\cdot}5248/C$. From the above relationships it is possible to calc a formula connecting n_D^{20} and d^{20} for each series. The divergence between experimental and calc values is greater in the case of cyclic compounds than in the case of straight-chain compounds, especially for the lowest and highest members of the series. A similar relationship is to be found for the alkylbenzenes, except that in the case of this series there is no linear relationship between n_D^{20} and d^{20}, as is shown by the following expressions for this group: $n_D^{20} = 1{\cdot}4752 - 0{\cdot}1125/(C - 2{\cdot}30)$; $d^{20} = 0{\cdot}8513 + 0{\cdot}0535/(C - 4{\cdot}00)$. V. B.

1183. Physics and Chemistry of Hydrocarbon Gels. E. K. Rideal. *Nature*, 1949, **163**, 665 (Report of Royal Society discussion, Mar. 24, 1949).—The use of hydrocarbon gels as flame throwers has stimulated research into the properties of such systems. The gel-forming polymeric network can be obtained by: (*a*) swelling and dispersion (*iso*butyl methacrylate or cellulose acetate); or (*b*) chemical reaction (aluminium soaps of fatty acids).

In a gel, elastic energy may be stored as orientation energy in the flexible chains, as potential energy in the bent valency bonds, or as a twist against the hindered potential opposing free rotation about the C–C axis. It can be shown that the rigidity of the network is proportional to (vol)^3 for the energy stored in the chain entropy, and to (conen)^3 for twisting against hindered rotation. The phase behaviour of polymer and solvent for cellulose acetate is discussed.

The point of thixotropic breakdown is important, since thixotropic systems can store potential or elastic energy when distorted. The breakdown point is associated with a balance between the rates of bond formation and breaking; and if these are regarded as independent rate processes, the anomaly in the viscosity-shear curves can be interpreted. From theoretical arguments it appears that not one, but two, physical parameters are required to describe the flow properties of these solutions.

Aluminium soaps, used as gelling agents, can be regarded as derivatives of $[Al(OH)_6]H_3$ and $[(H_2O)_4Al]Cl_3$. The existence of tri- and mono-soaps is doubtful, and those hitherto described are mixtures of the di-soap $Al(OH)L_2$ with adsorbed free fatty acid or hydrated alumina. H. C. E.

1184. Hydrocarbon Ion Appearance Potentials. J. J. Mitchell and F. F. Coleman. *J. Chem. Phys.*, 1949, **17**, 44–55.—Discussion of the effect of impact parameter, distribution of electron energy, and transition efficiency upon the appearance potential for ions from hydrocarbons in the mass spectrometer leads to the conclusion that initial ion-current onset is a correct measure of the appearance potential. Appearance potentials were determined for ions from six paraffins and four olefins. It is concluded that dissociation energies computed from these appearance potentials are greater than true bond energies, because electron collision processes give rise to excited fragments. The excitation energy appears to be greater for larger molecules. W. E. M.

1185. The Mercury Photosensitized Hydrogenation of Propylene. W. J. Moore. *J Chem. Phys.*, 1948, **16**, 916–919.—The hydrogenation of propylene in the presence of mercury vapour and under the influence of ultra-violet light has been investigated at 30°, 110°, and 200° C. A mercury-resonance discharge tube provided an intense source of 2537 Å. The hydrogen : propylene ratio was 8 : 1, and the hydrocarbon products were analysed with a mass spectrometer. The occurrence of 2 : 3-dimethylbutene as the principal C_6 product indicates that a hydrogen atom adds preferentially to the terminal carbon of propylene to form the isopropyl radical:

$$H + CH_3{-}CH{=}CH_2 \longrightarrow CH_3{-}CH{-}CH_3{-}$$

Analysis of the C_6 and C_9 products suggests that the isopropyl radical adds preferentially to the middle carbon atom of propylene. W. E. M.

1186. Infra-Red Absorption Spectrum of Mono-Deutero-Ethane under High Resolution. L. R. Posey and E. F. Barker. *J. Chem. Phys.*, 1949, **17**, 182–187.—The infra-red spectrum of C_2H_5D has been investigated under high resolution. As expected, the bands corresponding to degenerate vibrations of C_2H_6 are split into two components with oscillations in the symmetry plane and normal to the symmetry plane respectively. Analogues of several of the inactive C_2H_6 frequencies have also been observed. W. E. M.

1187. Kinetics of the Thermal Decomposition of *iso*Butene. M. Szwarc. *J. Chem. Phys.*, 1949, **17**, 292–295.—The thermal decomposition of *iso*butene was found to be a homogeneous reaction of the first order. The products of the decomposition included H_2, CH_4, and allene. The experimental results are explained in terms of a chain mechanism, the initiating step being the decomposition of the *iso*butene molecule into an H atom and a $CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CH_2$ radical. The most probable value of the D(C—H) in *iso*butene is 76 cal/mole. W. E. M.

1188. Kinetics of the Thermal Decomposition of Propylene. M. Szwarc. *J. Chem. Phys.*, 1949, **17**, 284–291.—The thermal decomposition of propylene was investigated between 680 and 870° C with percentages of decomposition from 0·01 to 2%. The reaction was shown to be a homogeneous reaction of the first order. Two mechanisms are discussed, both of which account for the observed kinetics and products of decomposition. It is demonstrated that the first step in the thermal decomposition of propylene is the splitting of the C–H bond leading to the formation of H atoms and alkyl radicals. W. E. M.

1189. Raman Spectra of Polycrystalline Hydrocarbons at Low Temperatures. Rotational Isomerism. II. D. H. Rank, N. Sheppard, and G. J. Szasz. *J. Chem. Phys.*, 1949, **17**, 83–85.—Making use of the low pressure, water-cooled Hg arcs as the source of nearly monochromate radiation, a simple method was developed for the investigation of the Raman spectra of polycrystalline solids. The first four normal paraffins were studied. The Raman spectra of the solids between 600 and 1500 cm^{-1} are compared with those in the liquid phase. All these spectra undergo a marked simplification on solidification due to the disappearance of all but one of the rotational isomers. This process is shown to be discontinuous at the m.p. W. E. M.

1190. Spectroscopic Studies of Rotational Isomerism. III. The Normal Paraffins in the Liquid and Solid States. N. Sheppard and G. J. Szasz. *J. Chem. Phys.*, 1949, **17**, 86–92.—The Raman spectra of *n*-butane, *n*-pentane, *n*-hexane, and *n*-heptane have been investigated in the liquid and solid phases. At room temperature the spectra show appreciable concn of rotational isomers, two in butane and pentane, and three in hexane and heptane. In the solid phase only one of these isomers is present—probably the planar, trans, zig-zag configuration.

The spectra of the solids give experimental values for the limiting skeletal stretching frequencies of the zig-zag form, and these are compared with values calc by previously established methods. The photo-electric spectrograph was used for quant intensity measurements on selected line pairs of each molecule over appropriate temp intervals, and from the results vals were obtained for the energy difference, $-\Delta H$, between rotational isomers. The vals obtained were 760 ± 100 cal/$mole^{-1}$ in *n*-butane, 450 ± 60 cal/$mole^{-1}$ in *n*-pentane, 520 ± 70 in *n*-hexane, and 470 ± 60 cal/$mole^{-1}$ in *n*-heptane. The observed gaseous heat capacities were compared with vals calc by statistical mechanics. It was found that for *n*-pentane and *n*-hexane the calc vals do not agree accurately with the experimental results, probably because of the simplified partition functions used to obtain the compositions of the isomeric mixtures. W. E. M.

1191. Spectroscopic Studies of Rotational Isomerism. IV. 2-Methyl Butane and 2 : 3-Dimethyl Butane. G. J. Szasz and N. Sheppard. *J. Chem. Phys.*, 1949, **17**, 93–97.—The Raman spectra of 2-methyl butane and 2 : 3-dimethyl butane were investigated in the liquid and the solid phases. All the main lines persisted in the solid phase. The slight change with temp in the relative intensity of one line pair in liquid 2-methyl butane was investigated quantitatively with the photoelectric spectrograph. No measurable intensity changes were observed in the 2 : 3-dimethyl butane spectrum. The results may be interpreted in terms of either a very small or very large energy difference between rotational isomers (*i.e.*, <100 cal/$mole^{-1}$ or >1600 cal/$mole^{-1}$). Accurate gaseous heat capacities would distinguish between these alternatives. The spectroscopic data on 2 : 3-dimethyl butane are inconsistent with a single molecular configuration possessing a centre of symmetry. W. E. M.

1192. Solubility Data for Ternary Liquid Systems (Systems of Acetic Acid, Higher Boiling Homologous Acids, and Water). D. F. Othmer, J. Serrano, Jr. *Industr. Engng Chem.*, 1949, **41** (5), 1030–1032.—The specific gravities and mutual solubilities at 25° C of the ternary systems, water, acetic acid, and each of the following acids: caproic acid, 2-ethyl hexoic acid, and 2-methylbutyric acid. These data allow analysis of mixtures of acetic acid and each of these higher acid solutions. Plait points, tie lines, distribution coeffs, and effective concn curves are presented. The solubility relations of the water–acetic acid–caproic acid system are indicated. R. G. T.

1193. Relationship of Thermodynamic Properties to Molecular Structure (Heat Capacities and Heat Contents of Hydrocarbon Vapours). M. Souders, Jr., C. S. Matthews, and C. O. Hurd. *Industr. Engng Chem.*, 1949, **41** (5), 1037–1046.—Correlation methods for the prediction of heat capacities and heat contents of hydrocarbons in ideal state have been developed on mol-structure basis. Results for the structural groupings necessary to the correlation are tabulated over temp range −250 to 3000° F. Over this range extensive tabulations of figures for many hydrocarbons in the ideal state are made. Similar figures of latest values for common gases are included. Less than 3% variation from other experimental measurements is recorded by this prediction. Comparison is also good with results of statistical mechanical methods.
R. G. T.

1194. Planar Vibrations of Benzene. B. L. Crawford and F. A. Miller. *J. Chem. Phys.*, 1949, **17**, 249–256.—A normal co-ordinate treatment has been carried out for the planar vibrations of benzene and its deuterium derivations. Eighteen of the twenty-six force consts have been determined. W. E. M.

1195. Assignment of the Vibrational Spectra of Ethyl Mercaptan and the Ethyl Halides, and the Characterization of an SH Deformation Frequency. N. Sheppard. *J. Chem. Phys.*, 1949, **17**, 79–83.—An assignment is given for all the fundamental modes of vibration of the ethyl mercaptan mol from the observed vibrational spectra. By analogy the observed frequencies in the spectra of ethyl chloride, bromide, and iodide are also assigned.

Evidence is presented that one of the deformation modes of the SH linkage in mercaptans has a characteristic frequency lying between 800 and 900 cm^{-1}. This frequency is usually stronger in the Raman spectrum. W. E. M.

1196. Assignment of the Vibrational Spectra of the C_4 Hydrocarbons Butyne-1, Butene-1, and Vinyl Acetylene, to the Normal Modes of Vibration of these Molecules. N. Sheppard. *J. Chem. Phys.*, 1949, **17**, 74–78.—An attempt is made to assign all the normal modes of vibration in terms of frequencies observed in the infra-red and Raman spectra. With the help of these assignments previous data on the frequency ranges characteristic of the various hydrogen deformation modes of the groups ethyl, vinyl, and $-C\equiv CH$ can be extended to include all such modes. W. E. M.

Analysis and Testing.

1197. Absorption Cell and Loader for use in Microanalysis by Infra-Red Spectroscopy. S. H. Wollman. *Rev. Sci. Instrum.*, 1949, **20**, 220–222.—A description is given of a cell, fitted with salt windows, which has a thickness of 1 mm and a volume of 12 cu. mm. The cell is mounted on a cell-holder which can be placed close to the spectrometer slit and can be adjusted so that the cell is accurately parallel to the slit and centred along the axis of the instrument. A device for loading the cell is constructed from a ½-cc tuberculin syringe and a capillary pipette. H. C. E.

1198. Electron-Micrographic Structure of Shadow-Cast Films and Surfaces. R. C. Williams and R. C. Backus. *J. appl. Phys.*, 1949, **20** (1), 98–106.—Very small particles of substances of organic nature usually do not have sufficient electron-scattering power when mounted on a collodion film substrate in the usual manner of specimen preparation. In the "direct shadow-casting" process the specimen is coated by oblique deposition of a layer of material relatively opaque to electrons. It has been found that uranium or uranium oxide is the best shadow-casting material. It has not been found

possible to produce a usable substrate film smoother than the collodion and Formvar (polyvinal formal) film commonly used.

In the "pre-shadowed replica" method, the shadowing is first done with the specimen mounted on a glass surface. The surface of clean glass is found to have the smoothest structure of any material known with practically no discontinuities in elevation as large as 10 Å. It has been found that the most satisfactory shadowing material for this process is a palladium–platinum mixture.

Technical details of specimen preparation and shadow-casting are described.

D. F. J.

1199. A Positive-Replica Technique for Electron Microscopy. C. M. Schwartz, A. E. Austin, and P. M. Weber. *J. appl. Phys.*, 1949, **20** (2), 202–205 (Annual Meeting of the Electron Microscope Society of America, Franklin Institute, Philadelphia, Dec. 1947).—The technique which is described was developed during an investigation of journal-bearing behaviour. A negative replica of the sample surface is taken by polyvinyl alcohol (P.V.A.), and the negative replica surface coated with Formvar. The P.V.A. is then removed by dissolving in water, leaving a positive replica, the relief of which can be enhanced by shadow casting. Illustrations are given of wear-test specimens. D. F. J.

1200. Industrial Refractometers. A. Lassieur. *Chim. Anal.*, 1949, **31**, 102–105.—A brief description of three portable (pocket) refractometers made by French firms. V. B.

1201. Frictional Electrification of Dust and Pre-Ignition in the Hydrogen Engine. R. O. King, W. A. Wallace, and E. J. Durand. *Nature*, 1949, **163**, 729.—During work on a C.F.R. engine using hydrogen–air mixtures in any ignitable proportion and a C.R. of 10 : 1, it was found that in a very dusty atmosphere pre-ignition was so severe that experiments could not be continued. When an air-cleaner which removed only the larger dust particles was fitted, there was no pre-ignition. This result was interpreted as indicating that pre-ignition occurs when discharges of electricity take place between large particles which carry −ve charges and small ones which carry +ve charges. H. C. E.

1202. Mass Spectrometers. M. Boivin. *Chim. Anal.*, 1949, **31**, 5–9, 35–40, 61–64, 80–83.—A review, dealing with fundamental principles, followed by descriptions of apparatus of various types and a brief account of analytical applications. The literature is surveyed up to 1947. Ninety-seven references. V. B.

1203. Measurements of the Mechanical Properties of Polymer Solutions by Electromagnetic Transducers. T. L. Smith, J. D. Ferry, and F. W. Schremp. *J. appl. Phys.*, 1949, **20** (2), 144–153.—At a single frequency of oscillation, the mechanical behaviour of a conc polymer solution can be simply described by the dynamic rigidity, G', and the dynamic viscos, η'. Both G' and η' are generally found to be frequency dependent. In the method described, a conc polymer solution is sheared by a rod oscillating axially with a very small amplitude in a closed tube. The rod is driven by a coil in a magnetic field, and from electrical measurements on the coil the mechanical resistance and reactance of the system are calc by transducer relationships. Equations are given for obtaining η' and G'. The advantages and limitations of the method are discussed. D. F. J.

1204. Construction of Apparatus for the Study of Porosity. A. Houpeurt. *Rev. Inst. franç. Pétrole*, 1949, **4**, 95–102.—Three types of porosimeter are described, also three types of "solimeter" (apparatus restricted to measuring the vol of the solid phase). These have all been developed in the production laboratory of the Institut Français du Pétrole. For both types of apparatus those operating by both compression and decompression are designated as "push-pull." A field porosimeter has been designed that will operate on a core of 4 cm^3 and give 1% accuracy with a 10 cm^3 core. V. B.

Engine Fuels.

1205. Effect of Additives on Gasoline Engine Deposits. R. E. Albright, F. L. Nelson, and L. Raymond. *Industr. Engng Chem.*, 1949, **41** (5), 897–902. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—An investigation has evaluated gasoline additives such as antioxidants and T.E.L. for their effect on engine varnish and sludge deposits by laboratory and field tests. Passenger-car field tests show several gasoline antioxidants have similar deposit-forming tendencies—engine-design factors are of far greater importance than fuel composition. The low temp C.R.C. FL-2 procedure has been used in laboratory tests to correlate with commercial-vehicle operation. Thus, it has been shown that some antioxidants tend to increase varnish and sludge deposits, the extent of deposit formation being dependent on the hydrocarbon composition of the base fuel. T.E.L. had no significant effect on varnish and sludge deposits in laboratory trials. Reduction in deposits has been accomplished using experimental fuel additives, but these latter cause undesirable intake-value deposits. R. G. T.

1206. Antiknock Agents. H. A. Beatty and W. G. Lovell. *Industr. Engng Chem.*, 1949, **41** (5), 886–888. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting of Am. Chem. Soc., St. Louis, Mo.*)—Over 85% of U.S. gasoline has 1·5 ml T.E.L. per gal added. Use of this lead results in annual saving of 50 million brl of gasoline per year. T.E.L. is the chief of many anti-knock compounds, and is used with chlorine and bromine compounds which remove the lead from the engine. Anti-knock action depends on amount, fuel, and engine conditions. R. G T.

1207. Chromatography. R. Williams and J. V. Hightower. *Chem. Engng*, 1948, **55** (11), 133–138.—Present position in the development of chromatography is reviewed. The principles of operation are first discussed with possible general uses and adsorbents and column design. Commercial applications include vitamin purification, carotene, and streptomycin purification, petroleum refining, and separation of petrochemicals. R. G. T.

1208. Computing Combustion Volumes for Burning Oil Fuel. R. Gibbs. *Chem. Engng*, 1949, **56** (1), 112–114.—New method of computing combustion vol for fuel oil shows that degree of atomization has considerable effect. Theoretical principles of the combustion process, heat transfer, and oil-surface phenomena are discussed. Charts are presented showing correlations of combustion volume, flame temp, constituents of exit gas, % theoretical air, and amount of air per lb fuel. A numerical example is included. R. G. T.

1209. Relation of Structure and Effectiveness in Copper Deactivators. R. W. Watson and T. B. Tom. *Industr. Engng Chem.*, 1949, **41** (5), 918–923. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—The recent development and use of protective agents, called metal deactivators, based on the action of metals, particularly copper, as oxidation cats for hydrocarbons, is described. Chief use of these additives is in drive-away and Cu-sweetened gasolines and industrial lub. oils. Use in analytical chemistry as specific reagents for metal precipitation is mentioned. The relation of chem structure to activity of metal deactivators is explained by an extension of the co-ordination–complex formation theory. Important structural factors influencing the action of metal deactivators are: chelation, ring size, inner-complex salt formations, electron-donating tendency of hetero-atoms, combination of chelate groups, and coplanar configuration. Similar behaviour of deactivators in presence of soluble and metallic copper is recorded. Important deactivators are salicylaldehyde-1 : 2-diamine condensation products and their derivatives, and the dialkyldi-thio-oxamides. R. G. T.

1210. Combustion of Hydrocarbons (Free Radical Chain Reactions). P. L. Cramer and J. M. Campbell. *Industr. Engng Chem.*, 1949, **41** (5), 893–897. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem.*

Soc., St. Louis, Mo.)—Knocking characteristics of liq hydrocarbons in the Otto engine are correlated with previously published data on the initial reactions of ethyl radicals with typical paraffins, olefinic, aromatic, and hydroaromatic hydrocarbons. A free radical mechanism, based on relative amounts and reactivities of the H atoms in the hydrocarbon molecule, is postulated. The relative susceptibilities of paraffins to knocking, based on mol structure, are proportional to the number of secondary and tertiary H atoms in the molecules. Olefins give a similar relationship, but the agreement is poorer than that obtained with paraffins on account of the additional factors introduced by the double bond. Aromatic hydrogen is highly inert to reactions with methyl or ethyl radicals, a fact largely responsible for the comparatively high resistance of aromatic hydrocarbons to oxidation and knocking combustion. The comparative effects of T.E.L., iron carbonyl, and diethyl-mercury on the crit C.R. of certain hydrocarbons are discussed, and new experimental engine data are presented.

R. G. T.

1211. Inhibition of Deterioration of Cracked Gasoline during Storage. C. J. Pedersen. *Industr. Engng Chem.*, 1949, **41** (5), 924–928. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—Autoxidation of hydrocarbon constituents causes deterioration of cracked gasoline. Peroxides are formed, through a series of free-radical chain reactions, and converted into various monomeric and polymeric oxygenated products. Antioxidants inhibit deterioration by reaction with chain-propagating free radicals. Addition of antioxidants should closely follow cracking, since they are destroyed in the process of terminating chain reactions and are oxidized by some peroxides. Salts of multivalent metals (especially copper) accelerate autoxidation of gasoline-containing antioxidants, and should thus be removed or deactivated to enable the economical use of antioxidants in storage. Deactivators convert the metal-salt cats into stable chelate complexes devoid of pro-oxidant cat activity. Deactivators also should be added to gasoline with the antioxidant, if not before. R. G. T.

1212. Utilization of 2 : 2-Dinitropropane as a Cetane Number Improver. R. E. Albright, F. L. Nelson, and L. Raymond. *Industr. Engng Chem.*, 1949, **41** (5), 929–934. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—A summary is made of the technical aspects of using 2 : 2-dinitropropane for improving diesel oil Cetane No. A fraction of data of last six years is presented. Use of 2 : 2-dinitropropane is satisfactory, and pilot-plant quantities are available. Development and utilization of it depend on future demands on high-Cetane-No. diesel fuel and upon reduction in cost of dinitropropane as a result of increased production to meet demands for uses other than Cetane No. improvement. R. G. T.

1213. Inhibitor Concentration and Stability. R. H. Rosenwald and J. R. Hoatson. *Industr. Engng Chem.*, 1949, **41** (5), 914–918. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—Two general equations are derived to express the relation between extent of stabilization (measured by accelerated oxygen bomb) and inhibitor concn :

$$\log y = r + s \log x$$
$$y = a + bx + c \log x$$

where y = length of induction period and x = inhibitor concn. The equations were tested for thermally cracked and cat cracked gasolines with four antioxidants, *NN'*-di-*sec*-butyl-*p*-phenylenediamine, *N*,*n*-butyl-*p*-aminophenol, *tert.*-butylcatechol, and 2 : 4-dimethyl-6-*tert.*-butylphenol. R. G. T.

1214. Deposition of Lacquer and Sludge in Passenger Car Service. F. F. Farley and R. J. Greenshields. *Industr. Engng Chem.*, 1949, **41** (5), 902–906. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—Engine design, operating conditions, fuels, and lubricants are factors of decreasing importance in the formation of lacquer and sludge deposits in engines operated at low temp. Laboratory tests have established the undesirable effect of low jacket temps in promoting sludge formation. Lub. oils do not contribute

appreciably to deposition at low crankcase temp, oxidation proceeding at a negligible rate. Low-temp engine deposits are derived chiefly from incomplete combustion products of the fuel which by-pass the piston, condense in the oil film on the cylinder wall, and flow into the crankcase. As the oil is recirculated over the pistons, it is suggested that oxidation and polymerization of fuel combustion intermediates from lacquer on the pistons and sludge in the circulating oil. Sludge particles then agglomerate and coagulate in cooler and quiescent parts of the engine. In winter low crankcase-oil temp and low coolant-inlet temp are confirmed by extensive temp measurement during normal passenger car service. These also confirm the conclusions drawn from laboratory studies of engine deposition. Low-temp operation presents more difficult problems than are encountered at high temp. R. G. T.

1215. Polymethacrylates as Viscosity Index Improvers and Pour Point Depressants. W. L. Van Horne. *Industr. Engng Chem.*, 1949, **41** (5), 952–959. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—Synthetic polymers whose composition and mol. wt. can be controlled are suitable for use as V.I. improvers. Application of polymethacrylates in this respect to several lubricating stocks is described. The polymethacrylates act effectively as pour-point depressants for lub. oils. R. G. T.

1216. Sulphur–Tetra-ethyl-lead Interaction in Motor Fuels. H. K. Livington. *Industr. Engng Chem.*, 1949, **41** (5), 888–893. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting of Am. Chem. Soc., St. Louis, Mo.*)—The following conclusions are drawn from investigation of hydrocarbon blends of 40–95 O.N. containing 0·1–60 ml of T.E.L. per gal and 0·01–2·00% sulphur. (*a*) *S* compounds having the sulphur atoms in the same type of chemical combination have the same effect on T.E.L. when the fuels are compared at the same sulphur concn. (*b*) The loss in T.E.L. anti-knock efficiency for a given amount of a sulphur compound is independent of the total concn of T.E.L. added. (*c*) The loss in anti-knock efficiency is substantially independent of the O.N. or composition of the fuel. (*d*) For mixtures of sulphur compounds, those containing sulphur in different types of chem combination have an additive effect on the T.E.L. efficiency. (*e*) In a fuel containing thiophenic sulphur, the ratio of inactive to active T.E.L. is proportional to a power of the sulphur concn.

These conclusions justify the theory that during operation of automotive engines with fuels containing sulphur and T.E.L. interaction takes place between those components, which is a resultant of the chem equilibrium : $S + T \rightleftarrows U$ where S represents a sulphur compound or its reaction product, T represents an active form of tetraethyl lead, and U represents a tetra-ethyl-lead reaction product devoid of anti-knock activity. R. G. T.

1217. Oxidation Stability of Tetraethyl lead and Leaded Aviation Gasolines. E. L. Waters and C. J. Busso. *Industr. Engng Chem.*, 1949, **41** (5), 907–914. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—A study of the factors affecting the behaviour of leaded aviation gasolines on oxidation. Aviation-gasoline base stocks, initially stable, were rendered unstable by addition of T.E.L. · Concns of T.E.L. above 1 ml/gal had pronounced effect which was persistent in finished products containing normal amounts of reactive hydrocarbons (olefins, aromatics, and inhibitors). T.E.L. itself was shown to be extremely unstable towards oxidation, and showed response to inhibition similar to that shown by leaded aviation gasolines, although max stability levels were lower for T.E.L. Oxidation of T.E.L. before blending may adversely affect stability and inhibitor susceptibility of leaded gasoline. R. G. T.

Lubricants.

1218. Complex Thiophosphoric Amides as Lubricant Additives. J. D. Bartleson and M. L. Sunday. *Industr. Engng Chem.*, 1949, **41** (5), 948–951. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc. St. Louis, Mo.*)—Phosphorus pentasulphide reacts in two ways with primary and secondary amines. At *ca* 400° C addition occurs. Above this, further reaction occurs

with loss of H_2S and formation of N_2–P linkages. Acidic products are formed and react with inorganic bases to give salt-like products in high yield. A typical product of the above reactions made from $Ba(OH)_2$, phosphorus pentasulphide, and doctadecylamine is an excellent lub.-oil improver. It acts effectively as detergent, anti-oxidant, pour-point depressor, and V.I. improver in oils made by either solvent or acid refining.
R. G. T.

1219. Antiseizure Properties of Boundary Lubricants. R. E. Thorpe and R. G. Larsen. *Industr. Engng Chem.*, 1949, **41** (5), 938–943. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem.* 114*th meeting Am. Chem. Soc., St. Louis, Mo.*)—Anti-seizure properties of boundary lub. oils are usually dependent on shearing of tightly bound films chemically formed on the rubbing surfaces, thus avoiding shearing of metal-to-metal surfaces. Variation of the coeff of friction with speed has been studied in various modifications of the four-ball apparatus, to evaluate lub. oils. Friction of effective boundary lubricants is mainly independent of sliding velocity in the low-speed range (0·1–8 cm/sec). Poor boundary lubricants (those containing no polar constuents or, to a lesser degree, those containing polar mols capable of physical adsorption only) show relatively high friction, often increasing at high velocity to values shown by unlubricated surfaces. Contact resistance measurements and metal pick-up studies indicate that effective boundary-lubricants reduce metal-to-metal contacts to very small values. The actual magnitude of the coeff of friction under non-seizing conditions is determined largely by the adsorbed film thickness which the lubricant can maintain between rubbing surfaces. R. G. T.

1220. Friction and Lubrication. H. Stäger. *Schweiz. Arch. Ang. Wiss. Tech.*, 1949, **15**, 97–116.—A review. Fundamental concepts are discussed and the effect of temp on the coeff of friction between various materials illustrated. The distinction between boundary and hydrodynamic lubrication conditions is explained and the influence of surface finish on lubrication considered, also the adsorption of oriented mols on the surface. The film strengths of various organic materials and of metals are compared, the values for metals (except Hg) generally lie below those for liquids. It is pointed out that the favourable effect of an adsorbed fatty-acid film is lost if the temp rises above a crit value. The friction-reducing effects of such films is only evident with reactive metals (*i.e.*, forming soaps) and non-reactive metals (*e.g.*, Pt, Ag, Cr) do not respond. Curves are given showing decrease of time for film rupture with increasing load. Such tests show the favourable lubricating properties of emulsions. Emulsified lubricants vary in their adhesion to different metals, adhesion to copper being particularly good. Tests show that the ratio between viscosities in tension and in shear is greater for paraffinic than for naphthenic oils. E.P. lubricants are discussed and the desirability of excluding hydrodynamic effects in the testing of these is stressed. Cutting oils and the effects occurring in metal working are dealt with in some detail, the stresses in such cases being higher than in normal bearing operation. Factors governing the choice of a cutting oil for various operations are reviewed, and the importance of selecting an oil suitable for the materials being machined is emphasized. Curves indicate the decreasing efficacy of cutting media with increase in working speed. A tabulation of the various physical properties of cutting oils, *e.g.*, b.p., surface tension, dipole moment, dielectric const, etc., shows that no correlation can be drawn between such properties and cutting behaviour. This latter is governed by the chemical interaction between the oil and metal. The advantages of an inorganic phosphate-base coating (*ca* 0·001 mm), which is a good adsorbent for lubricant, on the surface of metals that are to be cold-worked is explained; such a coating assists in the removal both of frictional heat and of heat generated by the deformation of the metal.
V. B.

1221. Hypoid Gear Lubricants. C. F. Prutton and P. A. Asseff. *Industr. Engng Chem.*, 1949, **41** (5), 960–962. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem.* 114*th meeting Am. Chem. Soc., St. Louis, Mo.*)—Development of hypoid lubricants and typical data on several of the more common present-day products are discussed. The need of more extensive fundamental research on the lubricating factors is stressed in a general survey of hypoid lubrication. The future possibilities of hypoid lubrication are assessed. R. G. T.

1222. Oxidation of Lubricating Oils. G. H. Denison and P. C. Condit. *Industr. Engng Chem.*, 1949, **41** (5), 944–948. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—Several dialkyl selenides have been prepared and shown to be more effective inhibitors of oil oxidation than the corresponding sulphides. The dialkyl are more active than diaryl compounds. Strip-corrosion and engine-test data confirm inhibitory val of dialkyl selenides as determined by oxidation tests and show that they are fairly free from deleterious oxidation products such as are encountered with sulphur compounds.

Dilauryl selenoxide and selenone were shown to be thermally unstable above 81 and 140° C respectively, and release iodine from the peroxide test mixture. The peroxide reduction theory of oxidation inhibitor action has been shown to be applicable to dialkyl selenides. In this case, however, a partial regenerative mechanism decomposes the selenoxide to yield the original selenide in appreciable percentage. Selenide-inhibited oils form very little gum or sludge due to the fact that selenide oxidation products are thermally decomposed to non-gum-forming products instead of being further oxidized to strongly acidic materials which accentuate gum formation.

R. G. T.

1223. Oxidation of Lubricating Oils at High Temperatures. G. H. Denison and O. L. Harle. *Industr. Engng Chem.*, 1949, **41** (5), 934–937. (*Pet. Additive Symposium—Divn of Industr. Engng Chem. and Pet. Chem. 114th meeting Am. Chem. Soc., St. Louis, Mo.*)—Information on lub.-oil oxidation has been extended from bearing and crankcase temps to temps prevalent in the piston zone. Rates of O_2-absorption were determined at temps as high as 340° C. The rates of absorption over the range 170–340° C obeyed the Arrhenius law within experimental accuracy. At piston-area temp of 290° C and engine-sump temp of 90° C, assuming other factors equal, the overall oxidation rate in the piston area is 200,000-fold more rapid. Experimental activation energies for the initial step of oxidation centred round 33 k.cal in agreement with other investigations of reactions performed at lower temp on hydrocarbons. R. G. T.

Bitumen, Asphalt, and Tar.

1224. Asphaltic Surfacing at Baltimore Airport. B. E. Beavin. *Rds and Streets*, Apr. 1949, **92** (4), 58–59.—Baltimore airport has been surfaced with 367,658 tons of hot-mixed asphaltic concrete produced at the rate of 11,860 tons per week. Four layers, two of 3½ in and two of 1½ in, were laid, the bottom layers comprising well-graded on-the-site sand and gravel (100% passing 1-in-mesh screen) and 5½% 85–100 pen bitumen. 100–120 pen bitumen was used in the upper two layers. In every case the aggregate at a temp of about 300° F (149° C) and the binder at about 275° F (135° C) were mixed together for at least 45 sec. The gradings of the aggregates were controlled in such a way that highly satisfactory stability tests resulted using the Marshall Machine. A seal coat of bitumen cutback and white aggregate (passing ⅜-in. screen) was then applied. R. H.

1225. Continuous Wax Sweating Process. H. Ter Meulen. *I. P. Review*, Apr. 1949 **3** (28), 107–112.—The well-known " wax-sweating " process has been developed to admit of continuous running. It is carried out in a series of twenty-three lorries, each of which contains sixteen rectangular shallow pans arranged in two tiers. Each lorry takes 3·2 ton of wax–oil mixture charging stock (which normally produces about 1·4 tons of wax), and passes through a complete cycle of operations as follows : first into a cooling tunnel where it is moved along one lorry length at a time until it reaches the end ; then into and along a " sweating " tunnel in the same way ; when it arrives at the end of this tunnel, it goes into a melting chamber where the " sweated wax " is melted, run off into a collecting pan, and pumped to storage. At any particular instant therefore there is a lorry at every stage in the process. The temp of the air in the sweating tunnel is controlled to about 2° C below the melting point of the wax to be produced. The rate of filling and yield are balanced to produce maximum output.

R. H.

Special Hydrocarbon Products.

1226. Manufacture and Use of Soluble Oils and Greases. H. Plassat. *Rev. Inst. franç. Pétrole*, 1949, **4**, 80–95.—The requirements of a satisfactory cutting oil are

considered, with special reference to difficulties that may arise from low-temp storage. The theory of emulsion formation is briefly reviewed, and the surface tensions of some of the possible components of cutting oils are quoted. Composition (qualitative only) of various types of cutting oils is tabulated, and brief notes are given concerning special components. The development of the pet-chem industry makes possible the production of cutting oils that are entirely of pet origin. The choice of oils for various engineering purposes is briefly discussed. V. B.

1227. Tetraethyl Pyrophosphate as an Insecticide. C. Potter. *Nature*, 1949, **163**, 378.—The chem and physiological properties of tetraethyl pyrophosphate (T.E.P.P.) are described. T.E.P.P. may be applied as a spray or as an aerosol, and in the concentrations used it exhibits very little phytotoxicity. An insecticide containing 40% T.E.P.P. is now available commercially. H. C. E.

Derived Chemical Products.

1228. Detergency Testing. *Soap and Sanitary Chemicals*, Apr. 1949, **25** (4), 77. (*A.S.T.M. Annual Meeting, Committee D-12.*)—The meeting was held in New York on March 22 and 23, 1949, and included discussion of soil-test cloths and apparatus for detergency testing.

An apparatus used by General Motors was described and shown, together with test procedure and sample preparation. Other subjects discussed include: the Baker "Terg-o-Tometer"; a multiple-agitator-type laboratory-washing machine; canvas-disc tests; the Ross–Miles foam test; a method for determination of pH of detergent solutions; requirements for testing apparatus for emulsion cleaners; metal cleaning and soil detection using radioactive compounds; standard soils and standard methods for soil removal; and test cloths as used to evaluate detergents. W. M. H.

1229. Ethanol: Synthetic Processes Outrun Fermentation. H. W. Zabel. *Chem. Ind.*, Feb. 1949, **64** (2), 212.—Although 70% of ethanol production in America is now based on ethylene, manufacture being either via hydrolysis of ethyl sulphate or by direct catalytic hydration, the future of this industry is not assured.

The older method of manufacture, fermentation of molasses, is still active, though comparison, on an economic basis, will not be a clear issue until costs of the new processes become available. The application of sulphite-waste liquor as a fermentation agent, if successful, will make the fermentation processes more attractive.

Direct oxidation of natural gas to acetaldehyde is another competitor in the field, and it has been suggested that manufacture of ethanol from acetaldehyde may occupy the major position in the picture, in due course. O. M.

Miscellaneous Products.

1230. Studies on Aluminium Soaps II. Composition, Structure, and Gelling Properties of Aluminium Soaps. V. R. Gray and A. E. Alexander. *J. Phys. and Colloid Chem.*, 1949, **53** (1), 23–38.—Soaps were prepared by reaction between aluminium alkoxides and fatty acid. The heat of reaction, measured as a function of fatty acid added, indicated that not more than two fatty acid groups combine per aluminium atom. It is postulated that the product of aqueous metathesis of an alkali soap and an aluminium salt is an adsorption complex of fatty acid on alumina. A polymeric formula for aluminium soaps is proposed, based on sixfold co-ordination aluminium–oxygen octahedra. The phenomenon of peptization is discussed with particular reference to the peculiar effect of water. D. F. J.

1231. Guide to Pigments and Related Products (8). J. H. Martin and W. M. Morgans. *Paint Mnfr.*, May 1949, **19** (5), 165.—Brief notes are given on: cochineal, complex acid, consol colours, copper acetoarsenite, copper bronze, copper carbonate, copper sub-oxide, copper sulphate, cork dust, corrosion, counter-current, coupling, crimson toner, cupferron, decantation, deliquescence, dessicator, detergent, deuterium, diatomaceous silica, and diazo solution. D. K.

1232. Accelerated Weathering Tests for Assessing the Durability of Paints and Kindred Materials. Anon. *Paint Mnfr.*, May 1949, **19** (5), 156.—Brief descriptions are given

of the twin-arc weatherometer, an apparatus to determine atmospheric pollution, and the accelerated weathering machine; several photographs are included.

Initial results with the weatherometer show good correlation between results obtained and exposure under rural conditions as far as decorative aspect is concerned, but where protection is the criterion, results are unsatisfactory. The principle need revealed in early tests was the inclusion of a method for accelerating corrosion of specimen. $NaHSO_3$ spray was found to be promising but was later replaced by gaseous SO_2 at R.H. 100% and 40° C.

Test specimens are subjected to following conditions :—

(*a*) 3 hr exposure to relative humidity 100% at 40° C,
(*b*) 1 hr relative humidity 100% with SO_2 introduced at standard rate,
(*c*) 2 hr as for (*a*).

Daily cycle repeated for four consecutive days. In addition, panels subjected to accelerated weathering in weatherometer or left in atmosphere relative humidity 100% at room temperature for 5 days. Results compare very well with those obtained under very corrosive conditions.

Accelerated cycles are outlined for complete assessment of behaviour under rural, industrial, and corrosive conditions. D. K.

Engines and Automotive Equipment.

1233. New Dorman Industrial Unit. Anon. *Gas Oil Pwr*, 1949, **44**, 104.—The 4BK11 model has four cylinders of 105 mm bore and 130 mm stroke. At the top speed of 1500 r.p.m. the 12-hr output is 41 b.h.p., and the 1-hr rating is 45 b.h.p. Specific fuel consumption is 0·41 lb/b.h.p. hr at 1500 r.p.m., but the optimum value is 0·387 lb. The weight of the engine per b.h.p. is 32 lb, and the net weight is 1460 lb. C.A.V. fuel injection is used, and the lubrication is pressure-fed from a gear-type oil pump. H. C. E.

1234. New Kromhout Two-stroke Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 87–89.—The A-190 series of oil engines have two to six cylinders of 190 mm diameter and 350 mm stroke. At 430 r.p.m. the output of 50 b.h.p. per cylinder corresponds to a b.m.p. of 78 p.s.i.

Details of the engine construction are given. Dry-sump lubrication is employed in conjunction with a duplex-type oil pump, and a separate lub.-oil tank is therefore necessary.

In the fuel system the delivery valve is fitted to the injector instead of the pump, but is arranged to act in the reverse direction. Fuel supplied to the injector flows to the fuel pump and to a spill tank whenever the plungers are in the lower position. When these begin to lift, the pressure of the fuel closes a non-return valve and injection occurs. H. C. E.

1235. Pilot Injection for Oil Engines. Anon. *Engineer*, 1949, **187**, 392–393.—Diesel knock and combustion noise of vehicle oil engines can be to a very large extent eliminated by a new system of pilot injection. By using a special pump-cam profile, modified pump-delivery valve, and change in the design of the injector nozzle (details of all of which are given), full control of the initial stages of combustion is obtained. Fuel is injected at a low rate for the duration of the delay period, followed without interruption by the second part of the fuel at a higher rate, thus avoiding the very rapid pressure rise and consequent noise at the end of the delay period. A. C.

1236. Scottish Low-power Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 99.—This single-cylinder engine has 4½-in bore and 4-in stroke. Its top output is 8 b.h.p. at 1200 r.p.m., and the fuel consumption is 0·43 lb/b.h.p.hr. C.A.V. fuel-injection equipment is fitted. Throughout there is forced lubrication fed by a gear-type pump.
H. C. E.

MISCELLANEOUS.

1237. New Ports on Aruba and Curaçao. J. F. Groote. *Ingenieur*, 13.5.49 (No. 19), B-51–63).—The article describes the building of Oranjestad on Aruba and developing the natural harbour in the Schottegat, Curaçao.

A detailed description of each, the concrete quay and structures at Aruba and steel erections in the case of Curaçao is given. In connexion with the latter, prevention of corrosion with cathodic protection of the steel is outlined.

A section of the article deals with comparative shipping tonnages year by year, at existing ports.

Finally, the costing is detailed and explained.

Illustration of the article is by maps, diagrams, and photographs. A. H. B.

1238. Domestic and Foreign Periodicals in the Field of Petroleum Chemistry—A Statistical Analysis. F. S. Boig and K. A. Loftman. *Oil Gas J.*, 21.4.49, **47** (51), 199.—On a similar basis to that of a more comprehensive study inaugurated some months ago, a statistical analysis has been made of the literature pertaining to the pet industry and pet chemistry. For this purpose, data have been collected of articles abstracted in the pet section of *Chemical Abstracts*, this publication being acknowledged the most complete in the world. The information covers a pre-war year, 1937; a war year, 1942; and a post-war year, 1947, with respect to (1) the leading domestic and foreign journals, number of articles abstracted from each, and relative position according to the number of abstracts; (2) Similar data from the aspect of: (*a*) country of publication, (*b*) language; (3) Percentage of all abstracts according to: (*a*) country and (*b*) language.

Some points of interest from this analysis are: Total abstracts published, and total journals for the years indicated are, respectively, 577, 572, 895, and 147, 156, 205; average contribution in about four articles per journal; there has been little change in the order of precedence as to the number of abstracts per country, *i.e.*, U.S.A., U.S.S.R., England, France. The Russian language is second in importance, after English; and ranks far ahead of French and German. W. H. C.

1239. Official [French] Classification of Petroleum Products According to their Hazard. G. Daric. *Rev. Inst. franç. Pétrole*, 1949, **4**, 102.—A table showing the classification of gaseous, liquid, and solid pet products according to the regulations governing storage, transportation, insurance, customs, and international inland waterways (Hague Convention). The classification is based on pressure for gaseous products and on flashpoint for others. V. B.

1240. [French] Refining Statistics. Anon. *Rev. Inst. franç. Pétrole*, 1949, **4**, 101.—Figures for February 1949 show a total crude import of 914,279 tons (88% from Middle East). Details are given showing the output of various pet products (divided into seventeen groups) and the means of transportation used for their distribution (road, rail, water). V. B.

1241. The Polish Institute of Petroleum. *Zycie gospodarcze*, 1948, No. 17a, 27–30; *Rev. Inst. franç. Pétrole*, 1949, **4**, D-34.—This was founded in 1945 at Krosno (Galicia). Its aims are to carry out scientific research, improve existing methods, carry out investigations on behalf of the industry, and educate workers in the pet industry. The institute is divided into five sections: production, engineering, chemistry, education, and administration and editing. It publishes a monthly journal *Nafta* and has a library of nearly 9000 volumes which receives forty-nine Polish and twenty-one foreign periodicals. The headquarters are at Cracow. A brief enumeration of the work carried out in 1947 is given. V. B.

1242. The Action of Chlorine and Bromine on Substances in Water used for Drinking and for Swimming Baths. N. D. R. Schaafsma. *Ingenieur*, 13.5.49, (10), G. 17–22.—The article describes the possible advantages of bromine over chlorine in certain cases and advises the installation of a bromine-dosing apparatus, which is described and illustrated.

Several sections of the article deal with: (1) the action of chlorine on ammonium compounds and (2) the action of chlorine and bromine on sugar, phenol, and on urea. Each of these actions is illustrated graphically. A. H. B.

1243. Coal Chemicals (Commodity Survey). Editor. *Chem. Engng*, 1949, **56** (2), 118–119.—A survey of coal chemicals which mainly derive from coke, tar, gas, light, oil, and ammonia. Coke-oven capacity is limiting factor in production figures. Economic factors are discussed, and future prospects assessed. R. G. T.

1244. Survey of Cycling Plants. Anon. *Oil Gas J.*, 21.4.49, **47** (51), 157.—Details are given of the company, field or plant, county, and capacity of cycling plants in the following States of America. A summary shows :—

State.	No. of plants.	Gas capacity, million cu. ft./day.	Total liquid production, g.p.d.
California	3	225,000	694,000
Colorado	1	32,000	27,000
Louisiana	9	810,000	2,043,600
Mississippi	1	100,000	400,000
Texas	34	2,651,000	4,029,700
Total	48	3,818,000	7,194,300

The present operating plants out-turning L.P.G. are twice the number of those producing only natural gasoline and heavier liquids. The total liquid production for 1948 was 38% above the 1947 output. W. H. C.

1245. The Economist Appraises Process Industry Prospects. McGraw-Hill Dept. of Economics. *Chem. Engng*, 1949, **56** (2), 98–104.—A general survey of economic factors at present affecting process industries includes reference to pet, and coal products. R. G. T.

1246. Survey of Natural-Gasoline Plants. Anon. *Oil Gas. J.*, 21.4.49, **47** (51), 149.—This survey covers the information as to the company, field or plant, county, and liquid production per day, of natural-gasoline plants operating or scheduled for operation early in 1949 in the U.S.A.

The individual figures for each state are shown for the number of plants and liquid production for :—

(1) plants equipped solely for natural gasoline; production numbering 232, and producing 3,574,775 g.p.d., and

(2) plants for manufacturing both natural gasoline and liquid petroleum gases, *i.e.*, 253, and 16,234,050 g.p.d.

A total of 485 plants with a capacity of 19,808,050 g.p.d. The last figure shows an increase of 35% over that of 1948. W. H. C.

1247. Oil Production Research. T. A. Pollard. *Petrol. Engr*, Mar. 1949, **21** (3), B-24.—This is an exhaustive article on the application and organization of research. The particular applications of research to production problems are discussed. C. G. W.

1248. Oil Refineries as Sources of Town Gas. Anon. *Coke and Gas*, 1949, **11**, 169–172.—When the pet-refining capacity of the U.K. attains 20 million tons/yr (1953) an estimated 1 million tons/yr of refinery gas, having a cal. val. of 500 million therms will be available, representing the equivalent of approx 25% of the town gas now sold. If 5*d*/therm ex refinery can be obtained, the sale of such gas and, if necessary, the use of alternative fuel by the refineries themselves, should be attractive to the pet industry, whilst the gas industry should be capable of meeting an additional (max) 2*d*/therm delivery charge, such as would be involved by the longer sections of the envisaged

refinery gas grid. The saving of capital expenditure on plant expansion, which such a scheme would enable the gas industry to make, is stressed as a factor of national importance. V. B.

1249. The Engineer Appraises Process Industry Prospects. A. J. P. Wilson. *Chem. Engng*, 1949, **56** (2), 105–106. Present trends in process industries are assessed from the engineer's point of view. Classified industries include petroleum and coal products. R. G. T.

1250. Petrochemicals (Commodity Survey). Editor. *Chem. Engng*, 1949, **56** (2), 120–121.—A survey of economic factors affecting production of petrochemicals. Individual companies' projects are reviewed, and future prospects assessed. R. G. T.

1251. Survey on Refining Training Practices. H. D. Kolb. *Oil Gas J.*, 28.4.49, **47** (52), 98.—An analysis of the training activities at 144 out of 188 U.S. petroleum refineries having a nominal daily throughput of 5000 b.d. or more is given.

The analysis covers supervisor, craft, process, and staff training; and general observations include statements that training in refineries is expanding, larger plants can be expected to be more active in training, and the problem of training the trainers remains. G. A. C.

1252. Rheology for the Technical Man. A. de Waele. *Paint Technol.*, May 1949, **14** (161), 205.—Rheological curves of non-Newtonian material give essentially the relationship between shearing stress and rate of shear, and may cover a range from lowest rates of flow recorded to those where turbulence begins. The function of rigidity as one of the component factors of plasticity, and the way in which it manifests itself can be illustrated by the " spring and dashpot " diagram. Threshold rigidity can be illustrated by use of the static form of the Pryce–Jones thixotrometer. When a true fluid is sheared, the shear set up is continuous and extends through the moving part of the system. In a fluid containing a disperse phase, the dispersed particles offer local interruption to the continuity of flow and are carried along streamline. Heterogenous systems containing an insoluble phase show greater degrees of flow resistance than the parent media. A mechanism is described illustrating the flocculation process in an analytical manner, but it does not apply for all systems. Specific adsorption of powders and sedimentation volume of suspensions increase progressively as particle size decreases. Flow point ratios can be followed by mechanically working a fluid into a solid powder until " wet point " is reached, then further dilution until a freely flowing cream is obtained. This ratio, together with sharpness or otherwise of flow point, is used as a criterion of type of system formed and depends on interfacial relation between component phases. Rheological diagrams are discussed, and explanations of non-linearity of the curve are given. The derivation of the intrinsic mobility ratio is considered. For wider use of rheological measurements the publication of more experimental data is necessary, together with their interpretation in the light of comprehensive analytical treatment. D. K.

1253. Waste Disposal. Report. *Chem. Engng*, 1949, **56** (3), 96–120.—A survey of waste-disposal problems includes the problem of oil-refinery wastes, by-product coke wastes, and concludes with a discussion of federal waste law. R. G. T.

BOOK REVIEWS.

Conversion of Petroleum. A. N. Sachanen. New York: Reinhold Publishing Co., 1948. Pp. xii + 602. 66*s*.

The second edition of Dr Sachanen's well-known book on the conversion of petroleum is very welcome because it is the first text-book dealing with the production of motor fuels to include the many advances of the war years. The remarkable development of the "cracking art" since the appearance in 1940 of the first edition of this book is illustrated by the fact that the second edition contains 600 pages as against 300 in the first edition. Processes such as catalytic cracking, alkylation, isomerization, and hydrogenation which were in the pilot-plant stage in 1940 are now fully developed, and the vast technical literature dealing with them is collected for the first time in the respective chapters of this book. In order to keep the book within reasonable limits the author has omitted consideration of patent literature and has exercised a critical selection of the published data.

The title "Conversion of Petroleum" is a little misleading, and the sub-title, "Production of motor fuels by thermal and catalytic processes," more adequately describes the contents. After an introductory chapter on "Thermal and catalytic reactions" in which fundamental reactions of hydrocarbons are discussed, the following chapters deal with "Conversion of petroleum gases in motor fuel," "Non-catalytic cracking," "Catalytic cracking," "Hydrogenation," "Treatment of synthetic gasolines," "Synthetic gasolines," and "Synthetic products other than gasoline." The fundamental principles involved in each process are thoroughly discussed and illustrated by well-chosen examples from the literature. Chemical engineering data, mechanical equipment, instrumentation, etc., are outside the scope of the book, but flow diagrams of the more important commercial units are given, and the section dealing with cracking coils and furnaces is particularly well illustrated. One or two of the flow diagrams, however, have been so reduced in size as to make them of little value to the student unfamiliar with the particular unit.

In the introductory chapter on thermal and catalytic reactions the author makes wide use of the free energy of formation of the hydrocarbons and free-energy changes involved in various reactions. For many refinery operators and process engineers, to whom the book will have a special appeal, a brief introduction to the thermodynamics of hydrocarbons and a discussion on the significance of free-energy changes would have been of great value. A similar criticism applies to the treatment of rate of cracking, where a brief account of the order of reaction and derivation of the rate constant might have been included with advantage.

The book contains one or two typographical errors, and certain authors appear with unusual initials. Otherwise the production is in the usual Reinhold standard, but the price, 66*s*., is high and places the book out of the reach of many students and petroleum chemists.

F. M.

The Technology of the Fischer–Tropsch Process. B. H. Weil and J. C. Lane. London: Constable and Co. Ltd., 1949. Pp. 248 + xii. 22*s*. 6*d*.

In spite of the ever-increasing figures for proved world crude reserves there is no lessening in the interest being taken in the development of synthetic processes for the production of oil from coal and other raw materials. That operation on a large scale is possible was demonstrated in Germany, where the annual production of oil from coal during 1939–45 reached over 4 million tons, about 14% of which was made by the Fischer–Tropsch process. Recently, the main centre of activity has been in the United States, where both the Government and the oil industry are engaged in research and development work on the Fischer–Tropsch and other processes.

As operated in Germany the Fischer–Tropsch process gave a primary liquid product, the spirit fraction of which was of poor quality. Largely as a result of American investigators, a modified process has been develped which yields motor spirit of 80 O.N., and it is now considered that the Fischer–Tropsch process is a

most promising method of obtaining liquid fuels and valuable by-products, using natural gas or coal as raw material.

The literature on the subject, including numerous reports of Allied investigations in Germany, has grown enormously in the past few years, and a text-book, devoted exclusively to the subject, has long been overdue. The present work was first published in the United States under the title "Synthetic Petroleum from the Synthine Process" (see *J. Inst. Petrol.*, 1948, **34**, 249A). The English edition contains some valuable additions and a welcome change of title. In the earlier edition most of the references to reports of Allied investigations in Germany were to American publications, not readily available to English readers. This fault has now been rectified and the appropriate references given to B.I.O.S., C.I.O.S., and F.I.A.T. reports. However, the reader still will find that all temperatures are given in degrees Fahrenheit, and for those closely interested in the process, the references to yields of primary product in terms of lb/cu. ft. will be unfamiliar.

In view of the rapid developments taking place in the Fischer–Tropsch and allied processes, the book is to some extent out of date, a criticism which applies in particular to the unduly long section dealing with the economics of the process in the United States. However, the book covers the literature comprehensively up to the end of 1946 and will serve as a valuable reference work. J. H. C.

Fuels and Lubricating Oils for Internal Combustion Engines. B. Pugh and J. M. A. Court. London: Sir Isaac Pitman & Sons, 1949. Pp. ix + 169. 15*s*.

The author of a short elementary text-book on a wide subject has two main requirements to fulfil. One of these is that he should give a broad, balanced, and comprehensive outline of the subject, and the second is that complete accuracy should be maintained, even in simplified treatments.

The writers of this book have chosen a very wide field with which to deal, and admit in the preface that their difficulty has been largely in deciding what subjects to exclude. There is some cause to fear that their selection may result in the reader previously unacquainted with the subject of internal combustion fuels and lubricants, acquiring a somewhat unbalanced view of the field.

Although the title is quite general, the authors have treated the subject largely from the aviation viewpoint, rather to the detriment of the book as a whole. Moreover, diesel engines—which after all are internal combustion engines—receive little mention, and the reader would gain no idea of the nature and properties (except perhaps as regards cetane number determination) of the fuels used in automotive, heavy, or marine diesels. Internal combustion turbine fuels are not mentioned. On the other hand, 10% of the 169 pages of text are given over to reproduction of the specifications for aviation gasoline and lub. oil issued by the former Ministry of Aircraft Production. Similarly, of the nineteen pages of the chapter on the "Meaning and significance of lubricating oil tests," fifteen are devoted to viscosity, and this is treated in a way which is perhaps too mathematical for an elementary text-book of this size.

Treatment of the manufacture of lub. oils is disappointing, the subject being dismissed in less than one page on a twenty-page chapter on the "Manufacture of fuels and lubricants from petroleum." A somewhat fuller treatment is necessary to give the student some real idea of how lub. oils are made and the components which enter into the finished product. The chapter on "Combustion" is perhaps the best and gives a satisfactory elementary review of the principal features.

The book contains a number of statements which are unfortunately erroneous or misleading to the student. A few examples are: the classification of petroleum products boiling up to 400° C, with "white spirits" having a boiling range of 90–270° C; gum formation in gasolines is largely the result of oxidation, and not of decomposition as might be inferred from p. 66; the C.F.R. MM. of O.N. determination does not rate fuels at slightly weaker air–fuel ratios than theoretical (p. 74), but at mixture strengths a little richer than theoretically correct; pure iso-octane and heptane are not now too expensive for routine engine-test use (p. 75), and in fact are often used for road-testing as well as C.F.R. work; it is not correct to infer, as on p. 87, that motor spirit is always dyed red; the information on p. 97 and p. 100 on the lead contents of fuels is not correct.

The difficulties of writing a book such as this are very great and made more so

by the restricted space available. The reviewer feels, however, that certain subjects could with advantage have been treated more briefly and others included or dealt with more fully so as to give the reader a better balanced picture. The addition of a short bibliography would also be useful to the student. Less emphasis on aviation matters might have been desirable in a book treating the subject as a whole, and it is suggested that careful revision on these lines would produce a book of real value to the elementary student. E. B. E.

The Physical Principles of Gas Liquefaction and Low Temperature Rectification. Mansel Davies. London: Longmans, Green and Co., 1949. viii + 205. 25*s*.

The author of this book has gathered together a considerable amount of working information from the field of low-temperature practice, and has presented this information clearly and concisely in relation to the theoretical aspects of the problems involved.

The individual processes are introduced by the appropriate thermodynamical treatment and discussed in terms of construction and operation of the equipment.

The principles of refrigeration, adiabatic and isentropic changes are set out in the first chapter. Simple cooling systems are analysed, together with the uses of various refrigerants. Adiabatic, cylinder expansion and Joule–Thomson expansion are treated fully, and the reasons for the differences between the conditions of maximum efficiency as shown by theory and found in practice are examined.

One complete chapter is devoted to the liquefaction of air in high-pressure circuits. This is followed by a thermodynamical analysis of the cooling process, comparing isenthalpic and isentropic cooling, the inversion of the Joule–Thomson effect, and other pertinent issues.

Two consecutive chapters deal with the mechanics of various cooling systems and the problems raised by heat transfer and leakage at low temperatures.

The rectification process is covered adequately, both in the theoretical treatment and in terms of equipment employed, the latter having particular reference to air. The book concludes with the outlines of some of the more important gas separations, including the rare gases, coke-oven and cracker gases.

This work is liberally illustrated with simple, clear diagrams, and refers the reader to most of the original papers on each topic. The general scientific reader should find it of considerable interest, and the student of chemical engineering or of gas-separation technology will find it of great value. S. H. B.

Geophysical Case Histories—Vol. I. Edited by L. L. Nettleton. Tulsa, U.S.A.: Society of Exploration Geophysicists, 1948. Pp. 680 + xii. $7.50.

The Society of Exploration Geophysicists has undertaken the task of compiling the case histories of oilfields in which geophysics has figured prominently, and this volume is the first of a series the society hopes to produce as more and more information becomes available.

The book is divided into six sections. The first is of an introductory nature, and contains two very interesting papers on the history and development of seismic and gravity methods. Four sections, comprising fifty-three papers, and divided according to geological province (Salt Dome, Mid-continent, Rocky Mountain, and California) are devoted entirely to the case histories of fields in the U.S.A., and the last section, which contains only four papers, is devoted to foreign fields (Venezuela, Germany, Hungary, and Kuwait).

As stated in the editor's foreword, the purpose of this case-history series is to provide material by which geophysical surveys can be judged from later development, thus aiding the interpretation and evaluation of other geophysical work. The fundamental value of such a project cannot be questioned, and the Case Histories Committee of the Society of Exploration Geophysicists is to be congratulated on making such an excellent start in its formidable task.

This first volume has been assembled from papers previously published in *Geophysics*, the *Bulletin of the American Association of Petroleum Geologists*, and the *Transactions of the American Institute of Mining and Metallurgical Engineers*, together with much new material specially contributed. Some of the previously published papers have been revised to include development since their original publication.

Although most of the surveys described were carried out by gravity and seismic

methods, there are a few cases where magnetic methods were used. A short description of a geochemical survey is also given, and mention is even made of the use of the divining rod for locating wells in Germany during the First World War! It has not been possible, however, to include any description of work carried out by the airborne magnetometer. The descriptions of the early refraction work of Seismos and the Geophysical Research Corporation, and of the torsion balance surveys, in the salt dome country of Texas and Louisiana round about 1925 makes interesting reading, and one cannot help feeling surprised how effective some of these early surveys and methods were. And it is worth noting that, when so much has been published in recent years on the development of underwater prospecting, as many as eleven salt domes were discovered in water-covered areas in nine months in 1927–28 by two G.R.C. refraction parties equipped for water surveys.

A number of the case histories are simple stories of a single geophysical survey, followed by development by the drill. Others are complicated histories of a series of geophysical surveys carried out over a period of years, as geophysical instruments and methods improved. The Cameron Meadows Dome in Louisiana, for example, was investigated over the period 1926–43 by no less than four refraction surveys, one torsion balance survey, three reflection surveys, and one gravity meter survey.

Nearly all the papers are preceded by an abstract. Some of the papers contain a substantial amount of geological information, others practically none. All of the case histories are profusely illustrated by maps and diagrams, and in a number of cases, in addition to the description of the results, details are furnished of field technique and methods of computation and interpretation. The book should therefore prove a fruitful source of ideas, quite apart from the purpose for which it is intended, and its appeal in the geophysical and geological professions should be wide. More conclusive proof of the immense value of practical geophysics to the oil industry could not be found in any other publication to-day.

Great care seems to have been taken to make full acknowledgments throughout the text, and the geophysical parties engaged on the various surveys are practically always named.

From the point of view of geophysicists on this side of the Atlantic, it is disappointing that so little information is available on foreign fields, though this, of course, is not surprising. It is to be hoped that more information on fields outside the U.S.A., particularly in the Middle East, will be made available to the editor of the next volume of the series, so that the section on foreign case histories will be much enlarged.

The book is well bound, beautifully printed on high quality paper, and has a substantial index. It is a worthy contribution to the field of geophysics.

D. T. G-J.

Trade Marks. H. Bennett. New York: Chemical Publishing Co., Inc., 1949. Pp. 479 + 4 "name finders." $10.00.

Mr Bennett is well known in the industrial chemical world in the U.S.A. as the technical director of Glyco Products Co., Inc., and states in his preface that he has many years experience in the coining of trade marks.

His book is intended mainly to be used as a guide to and outline of the principles to be employed in trade-mark selection, and should be of considerable use to manufacturers and merchants in this highly and increasingly important aspect of modern commercial and industrial life.

The chapters devoted to the legal position and registration facilities with respect to trade marks in the United States are extensive and lucid, and include a full reprint of the Rules of Practice issued by the U.S. Commissioner of Patents, which occupies some 143 pages and is followed by a full reprint of the text of the present U.S. Trade Mark Law (the "Lanham" Act of 1946).

While both these are readily available as official publications in the United States, no doubt their inclusion in a work of this nature is of value to a U.S. manufacturer or marketer, but appears of relatively minor interest to the citizens of other countries; however, the present dollar shortage, and the consequent importance of marketing British and western European products in the United States render valuable any hints which may assist British manufacturers to sell their goods abroad, and to avoid the grosser errors into which ignorance of the law may lead them.

When the author turns (p. 147) to the consideration of the protection of trade marks abroad, the information he supplies is of considerable interest, and gives a clear warning of the many pitfalls which arise in foreign marketing under trade marks, but some of the detailed information he gives is out of date—for example, in that no reference is made to the current trends of opinion (and, indeed, of legislation) in trade-mark ownership. The International Conventions for the protection of industrial property (referred to briefly on p. 173 and elsewhere) are revised from time to time, in accordance with the recommendations of associations of manufacturers and experts in trade-mark laws and practice, in the unceasing effort to bring laws into conformity with the real needs of international commerce. The revisions of the original text, made since 1925, are not apparently known to Mr. Bennett. Recently radical changes have taken place in the basic conception of what a " trade mark " is in essence, and these changes are already law in a number of countries. For example, assignment of a trade-mark right is now possible in Great Britain entirely divorced from the goodwill of the business in which it is used. On page 145, the author is apparently unaware of this change in British law, which was made in 1938, and of another main change in basic concepts introduced in 1938 in Great Britain, and since that date in New Zealand, Australia, etc., namely the " registered user " arrangement which, in effect, and subject to safeguards, permits the legal " licensing " of trade marks. The situation referred to by the author (pp. 191–192) where loss of trade-mark rights may result from a U.S. manufacturer being forced by import restrictions, etc., to allow a local manufacturer in England to mark English-made goods with the U.S. manufacturer's trade mark under license, has been an increasingly common one for the last two decades, and the " registered user " provisions of the British law render it possible to overcome this danger completely in nearly all cases.

The section of the book (pp. 203–230) relating to the coining of trade marks is a valuable addition to the relatively small number of works which deal with this most important subject, and here the author's analysis of the possible ways of tackling the problem should be of great value to the intending marketer of a new product, who very commonly has only the most rudimentary notions of how to set about finding a good brand name or trade mark for it.

The trade-mark " dictionaries " comprising the second half of this book (pp. 231–479) are divided into sections. That classifying marks by their types is of general interest only, as is a list given of old trade marks, but the two following lists, giving schedules of marks already used or adopted in different industries (lists A–D) should serve as a useful guide for those selecting a new trade mark. List E (pp. 347–479) gives the approximate or actual composition of trade-marked chemicals and allied products, and again should be of considerable value and assistance to purchasing agents, chemists, etc. J. A.

BOOKS RECEIVED.

Monographie Géologique du Champ Pétrolifière de Pechelbronn. René Schnaebele. Strasbourg: Service de la Carte Geologique de l'Alsace et de la Lorraine, 1948. Pp. 254.

This monograph, No. 7 in the series "Memoires du Service de la Carte Géologique de l'Alsace et de la Lorraine," is the result of nearly twenty years investigation on the part of the author and his two main collaborators, J. O. Haas and C. R. Hoffman. The Pechelbronn field, about 16 miles long and of a width varying from 1¼ to 3¼ miles, lies in the administrative department of Bas-Rhin.

Subjects covered by the volume include the stratigraphy of the Pechelbronn field, its tectonics; physico-chemical analysis of crude oil; gas strata; brine; geophysics; historical data and statistics, and the evolution of geological knowledge and methods of investigation.

The text is illustrated by six plates and many diagrams. Eleven loose charts, several in colour, are included.

Oil in Venezuela. Joseph E. Pogue. New York: Chase National Bank, Petroleum Department, 1949. Pp. 49.

An economic study based on an address presented at a meeting of the Asociacion Venezolana de Geologia, Mineria y Petroleo, Colegio de Ingenieros, Carasas, Venezuela. The pamphlet deals with Venezuela's petroleum resources, industry, and markets; the State's constitution and laws; and the economics of oil production in the State.

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Oilfield Exploration and Exploitation.

Geology.

1254. Aerial Mapping for Oil. G. P. Mott. *World Petrol.*, Mar. 1949, **20** (3), 66.—The application of aerial photography in mapping the geology of an area is described. C. G. W.

1255. Paleotectonic and Paleogeologic Maps of Central and Western North America. A. J. Eardley. *Bul. Amer. Ass. Petrol. Geol.*, 1949, **5**, 655–682.—This paper presents a series of twelve paleotectonic and five paleogeologic maps, which show the major stages of the evolution of the central and western part of continental North America from early Palæozoic to late Mesozoic times.

The tectonic maps show the belts of severe compression and igneous activity; the regions of epeirogenic uplift that were subjected to erosion; the areas which received less than 1000 ft of sediments; and the basins and troughs which received more than 1000 ft of sediments. The latter are contoured on 1000-ft intervals.

The series of paleogeologic maps starts with the outcrop pattern of the continent at the close of the Devonian, and presents views of it at the close of the Lower Pennsylvanian, the Permian, the Triassic, and the Jurassic.

The purpose of the author is to present the maps as preliminary copies, and to ask for assistance in correcting and adding to the data they show. E. N. T.

1256. Structural Relations on East Flank of Anadarko Basin, Cleveland and McClain Counties, Oklahoma. Lynn Jacobsen. *Bul. Amer. Ass. Petrol. Geol.*, 1949, **5**, 695–719.—The Anadarko basin, of western Oklahoma, has been found to be separated from the Central Oklahoma platform by a zone of buried large-scale faulting.

The major displacement is named the McClain county fault zone, which runs from north to south, with a total maximum throw of more than 2300 ft.

Numerous secondary faults are associated with the major fault zone. E. N. T.

1257. Geology of Green and Yampa River Canyons and Vicinity, Dinosaur National Monument, Utah and Colorado. G. E. Untermann and B. R. Untermann. *Bul. Amer. Ass. Petrol. Geol.*, 1949, **5**, 683–694.—The area discussed represents the deeply dissected eastern end of the Uinta mountains, which are east–west anticlinal folds. The oldest formation exposed is Algonkian, and the youngest, Pliocene. In much of the area, Mississippian, Pensylvanian, and Permian rocks form long dip-slopes towards the south.

Typical of Uinta Mountain structure and representative of the smaller folds that flank the main arch of the Uinta Mountains is the Split Mountain–Yampa Plateau area. Formations along the crest of this anticlinorium have low attitudes in contrast to the sharply flexed, steeply dipping, younger flanking formations. Lower Pennsylvanian and Lower Mississippian are exposed in the deeper part of Split Mountain Canyon. E. N. T.

1258. Secondary French Deposits of Bituminous Rocks. V. Charrin. *Chim. et Ind.*, 1949, **61**, 525–526.—Brief notes on bituminous rocks occurring in the Sarladais, Bugey, and Massif Central regions. The possibility of practical utilization of these deposits is considered. None would appear to be of major importance, but they might, nevertheless, be profitably worked; so far only a few isolated attempts have been made. The suggestion is noted that the distribution of a certain leguminous plant (*Psoralca bituminosa*) may indicate bituminous rocks. V. B.

1259. Bitumen Classification. W. Gothan. *Erdöl u. Kohle*, 1949, **2**, 173–175.—Earlier definitions are considered, and the classifications of Holde and Mallison quoted. It is pointed out that the term "bitumen" has a geological as well as a chem significance, and the following definition is proposed: "Natural hydrocarbon products occurring in sedimentary rocks, including coals, and extractable therefrom with suitable solvents or whose transformation products can be recovered by distillation." It is suggested that suitable solvent treatment for the extraction of bitumens is

tetralin for 6 hr at 206° C. It is further suggested that such bitumens can be subdivided into two classes having properties tending towards those of coal and of pet respectively. V. B.

Geophysics and Geochemical Prospecting.

1260. Offshore Exploration with Gravity Meter and Magnetometer. E. W. Frowe. *Petrol. Engr*, Apr. 1949, **21** (4), B-92.—The application of gravity and magnetometer surveys to offshore exploration is discussed. C. G. W.

Production.

1261. Oil Production by Gas Flooding. P. J. Jones. *World Oil*, Jan. 1949, **128** (9), 150.—Part 3 of a series. Vaporization in oil reservoirs. C. G. W.

1262. Gas Injection. M. Muskat. *Oil Gas J.*, 31.3.49, **47** (48), 89.—One of a series of summaries of lectures on various aspects of reservoir control. C. G. W.

Transport and Storage.

1263. Modern Gas-Pipe-Line Construction. F. E. Richardson. *Oil Gas J.*, 12.5.49, **48** (1), 99.—Steps in the development in pipeline construction which have contributed largely to the high degree of efficiency of the present day are outlined in chronological order.

In 1916 acetylene welding of pipeline joints was first used on a 9-mile 10-in line in Oklahoma; recent years have seen pressure welding (1941), cold bending machine for large-dia pipe (1943), X-ray of welds (1946), and hydraulic bending machine (1948).

Comments are given on the provisions of the specifications covering large-dia pipeline construction and equipment used in each operation. G. A. C.

1264. Preventive Maintenance of Pipeline Strainers. Anon. *Mech. World*, 1.7.49, **12** (3259), 23.—Periodical removal to a time schedule of accumulation of dirt caught by a strainer in a pipeline is essential. Although many types are in use, they all have a gauze filter and the most widely used type of strainer, the Y-type, can be taken as typical. The strainer pocket must be at lowest point to allow impurities to settle down. Frequent use of blow-out cock will keep screen free from dirt and sediment. When removing the screen, force must not be used, and any scale or sediment causing sticking should be dislodged by a cleaning solution. Scale can be removed from screens by caustic soda or paraffin, but careful rinsing should then follow to remove all traces. Usually washing with hot water and/or brushing will suffice. A system to ensure regular inspection and cleaning should be arranged. A. S.

1265. Remote Actuation of High Pressure Valves. P. R. Weber and J. C. Corby, Jr. *Mech. Engineering*, May 1949, **71** (5), 395.—A description is given of a method of remote control of valves controlling flow of fluids at pressures of 12,000 lb/sq. in. and over. An electrical mechanism for remote actuation of the valve has been developed, and a wiring diagram and view of the actuator and valve assembly are given to illustrate the principle of operation. A full description of the method of operation is also given. The advantages of the remote actuation system are listed, together with specifications for the various components of the actuating equipment. It was the aim to develop a control mechanism which would give results approaching as closely as possible those obtained by direct operation. The actuator developed has given highly satisfactory service. A. S.

1266. Underground Storage of Propane–Air and Natural-Gas Mixtures. H. le Fruechtenicht and J. B. Simpson. *Oil Gas J.*, 2.6.49, **48** (4), 70.—To meet winter demands for gas the Michigan Gas Storage Co., Mich., solved a difficult problem by the storage of high B.Th.U. gas, produced during the summer months, in a depleted

natural-gas field, and designed a unique plant for the mixing. The high B.Th.U. gas distributed consisted of natural gas, propane, and air, the propane had to be accumulated over some 3½ months for the peak demands. The investment cost for the equipment necessary for the storage of the vast quantity of liquid propane would be several million dollars, whereas the additional equipment needed for the unusual underground storage was only about $250,000. The mixing plant and its operation are described, and a flow sheet is given. The properties of the gas mixtures are described and discussed, and analyses are shown. Hydrate equilibrium curves and a plot showing allowable limits of the components in mixtures are shown and discussed. Mixing proportions, operational difficulties, costs, and testing are discussed. The liquid propane is delivered in tank cars, and transferred by pressure to a receiver from which it is pumped via a 4-mile, 4-in pipeline to the mixing plant. In 3½ months 11,570,900 gal of liquid propane were received for mixing. From 100,000 to 140,000 gal propane were mixed with 40–60 million cu. ft. natural gas of 0·685 gravity and 1000 B.Th.U., and sufficient air to bring back the cal. val. to the same value. The product being delivered to the 293 wells at 70° F (and 540 p.s.i.g.) to avoid hydrate troubles in the wells. This aspect is discussed as to: hydrate equilibrium points of the gas mixtures; hydrate bridges, their breakdown and avoidance; depths of, and temperatures in, the field strata. W. H. C.

1267. Basic Interpretation of X-Ray Photographs of Pipe Line Field Welding. R. R. Hughes. *Oil Gas J.*, 2.5.49, **48** (4), 55.—Brief descriptions are given of a light X-ray unit, electrically driven for travelling through a pipeline, and its technique. Developed by Industrial X-ray Engineers Co., Tulsa, it has been used to examine the welding of over 900 miles and 700 miles, respectively, of natural-gas and crude-oil pipelines. X-ray welding inspection of large pipelines is important from the aspect of public safety and low maintenance costs. The advantages of X-ray photographs over those of γ-ray (radium) are: sharper definition, greater contrast, density more conducive to complete interpretation, shorter film exposure. The X-ray tube is fitted on to three motor-driven wheels, so that the rays emanate from the centre of the pipeline. The power for the tube and motor is received through a cable which is drawn in by the unit as it travels through the line. Films, enclosed in a light-tight sheath, are fixed around the outside periphery of the line at each weld. When a weld is reached it is indicated by a lamp on the control panel in the mobile generator van, and the exposure is made. The unit travels at the rate of 40 ft/min. Although a mile can be traversed, it is preferable to limit the distance to less than 2000 ft. Safety control, fundamentals of X-ray theory, welds, welding, defects in welds, X-ray photographs and their interpretation are widely discussed. Photographs of the mobile van and equipment are shown. The X-ray photographs of welds and photographs of the pipe interior around the welds and also of the test pieces of the welds are fully described and discussed. W. H. C.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1268. Cost-imating. Pump Materials and Drives. W. L. Nelson. *Oil Gas J.*, 12.5.49, **48** (1), 121.—No. 30 in this series gives tables showing extra costs (1946) for turbine drives or explosion-proof motors, extra costs for special materials for centrifugal pumps, and cost of motors including line starter and safety equipment.

In addition, two equations are quoted for two classes of motors (open and totally enclosed). G. A. C.

1269. Cost-imating. Electrical Equipment. W. L. Nelson. *Oil Gas J.*, 26.5.49, **48** (3), 115.—No. 33 in this series gives tables showing approximate costs (dollars per kilowatt 1946) of electrical power-generating plant, electrical lines complete with poles, etc., and cost of miscellaneous electrical equipment such as conduits, lights, and telephone system.

Seven references are given. G. A. C.

1270. Cost-imating. Filter-Press Costs. (Petrochemical.) W. L. Nelson. *Oil Gas J.*, 2.6.49, **48** (4), 81.—No. 33 of this series gives tables showing approximate cost (1946) of filter presses in \$/sq. ft., for twelve drum areas, ranging from 20 to 1000 sq. ft., for the following: Sweetland presses (2-in and 4-in spacing); Oliver presses, without motor; recessed-plate and frame presses; plate and frame presses (two types).

Factors are given for obtaining the cost of presses made of aluminium, bronze, lead, and 18-8 stainless steel. Approx costs of installation and accessories are also shown.

W. H. C.

1271. Heat Transfer to Gases in Packed and Contact Tubes. R. Schumacher. *Erdöl u. Kohle*, 1949, **2**, 189–193.—Recent published work (chiefly American) is depicted graphically and critically discussed. It is shown that heat transfer in packed and contact tubes is, at Reynolds No. (referred to tube dia) >2300 approx 7½ times greater than in non-packed tubes. This value of the modified Reynolds No. is that at which turbulence commences, whilst complete turbulence is attained at a value 4 times greater. Shape, size, and material of the packing do not appreciably affect the heat transfer, the thermal conductivity of the packing being a factor of minor significance. It is suggested that conditions valid for gases will also apply to other flowing fluids.

V. B.

1272. Hydraulic Seals. Rotary, Oscillating and Reciprocating Types. (*Papers presented at Institution of Mechanical Engineers.*) *Auto. Engr*, May 1949, **39** (514), 202–208.—The object of these papers is to initiate a comprehensive discussion of existing knowledge on the subject which will perhaps indicate the fields to which future research and development might be directed.

Rotary and Oscillating Seals, T. E. Beacham.

At slow and intermittent speeds rotary oil seals with modern packings, even at high pressures, do not present much difficulty. At high speeds, however, wear and heat from friction become important factors. Normal stuffing boxes can be adjusted to overcome excessive leakage, but there are many types of non-adjustable or automatically adjustable shaft seals in use. Little is published regarding the life of the latter, viz., before leakage becomes so great that replacement is necessary. Standardized life tests, and the causes that affect length of service are discussed, and recommendations as to the tests are made. A typical shaft-seal life curve is presented and explained. There is no generally accepted standard as to the amount of gland leakage that can be tolerated. This aspect is discussed, and some data are quoted from British and U.S.A. official specifications, covering gland leakage in aircraft pumps. Many types of seals are shown in twelve drawings, and their construction, use, service qualities, etc., are described.

Reciprocating Seals, F. H. Towler.

Reciprocating seals have usually to cope with two conditions of pressure, slack and full, and when under full pressure have to withstand far greater pressures than rotary seals encounter, but rubbing speeds are lower. The "swept area" of reciprocating seals is defined for both a gland and a piston seal. The swept area being very large, the frictional heat is dissipated over a large area of wetted surface. The viscosity, lubricity, and chemical reactions of the liquid to be sealed, whether water, oil, or acid, or a combination of them, must be considered in designing. Types of reciprocating seals are: gland seals for piston-rods or press rams, piston seals, and packingless seals depending upon a lap fit between the piston and bore. Types of hydraulic packings and sealing materials, their behaviour under stress, friction or liquid contact, effect of motion, wear, sharp edges, surface finish, mechanism of automatic seals, packingless pistons, grooving of packingless pistons, hydraulic lock, and novel types are discussed. Eight drawings are included.

Thirteen references are given to the two papers.

W. H. C.

1273. Cost-imating. Large Motors. W. L. Nelson. *Oil Gas J.*, 19.5.49, **48** (2), 363.—No. 31 in the series gives a table showing costs (1946) in dollars for 440-, 2200-, and 4160-volt motor equipment, including estimated share of cost of incoming service feeder, transformer station, and circuit-breaker.

Another table shows approximate transformer costs, excluding auxiliary equipment. Comparisons for years 1926 to 1947 are given. G. A. C.

1274. Legal Aspects of Design, Fabrication, Certification and Use of Pressure Vessels. W. B. Ritchie. *Mech. World*, 29.4.49, **125** (350), 461.—The principal statutes vital to the subject are listed. The Acts, in the main, relate to the duties of users of pressure vessels regarding notification of explosions or accidents to the Government department concerned, and the latter's power to invoke enquiries or investigations. The pertinent points of some of these Acts are quoted. The Factories Act, 1937, and the Boiler Explosions Acts, 1882 and 1890, contain very brief definitions and/or stipulations as to boilers and pressure vessels. These are quoted, and, as they are capable of extremely broad interpretation, are discussed. The most far-reaching effect, however, is that the Boiler Explosions Acts operate whether the vessel is within the scope of the Factories Act or not, *e.g.*, in the case of steam and feed-water piping, coils, etc. All other vessels come under the Factories Act or any other Act. It is shown that in so far as pressure vessels or vessels which may unintentionally become exposed to pressure are concerned, the responsibility of users may, if an accident happens, involve designers, makers, or certifiers. The rules and regulations of the Board of Trade (Merchant Shipping Act) relating to the design and construction of ships' steam boilers, superheaters, steam pipes, evaporators, and receivers are discussed. The influence of the British Standards specifications, and the advantages of the engineering insurance companies certification of plants, in relation to designers, makers, and users of such vessels are discussed. *In toto* little assistance is afforded in the Acts to designers, manufacturers, and certifiers despite their great responsibilities. "It is submitted that the time is opportune for the introduction of statutory rules and regulations to control the design and manufacture of all boilers and pressure vessels." W. H. C.

1275. Safeguards and Precautions for Satisfactory Operation of Pressure and Non-pressure Vessels. W. B. Ritchie. *Mech. World*, 20.5.49, **125** (3253), 585.—A brief reference to the responsibility for safety measures shows that the legal view is that the onus of ensuring safety rests with the user, although in some cases makers have been held responsible for the technical omissions quoted.

Amongst other things, the Factories Act, 1937, specifies that ". . . every steam receiver not so constructed and maintained as to withstand with safety the maximum working pressure of the boiler, or the maximum pressure which can be obtained in the pipe connecting the receiver with any source of supply, shall be fitted with : a suitable reducing valve or any other suitable appliance to prevent the safety working pressure being exceeded, and a suitable safety valve so adjusted as to permit the steam to escape as soon as the safe working pressure is exceeded ; or a suitable appliance for cutting off automatically the supply of steam as soon as safe pressure is exceeded ; and . . ." Obviously the Act cannot define what constitutes a suitable safety valve, since these very considerably depend upon the prevailing circumstances, and it is left to the competent person issuing the certificate to judge each case on its merits, and to decide when the arrangement is satisfactory or not. This aspect is widely discussed as to the escape area of safety valves. Some years ago the Home Office and other interested parties came to an agreement that for certain vessels in the cotton industry, "such safety valves, for moderate reductions in pressure should have an area of about 1½ to 1¾ times the area of the inlet to the reducing valve, depending upon the ratio of reduction in pressure," and based on some assumptions which are given. These agreed ratios have been adopted by practically all the certifying authorities, and experience over the years has proved the compromise to be satisfactory. The requirements of the Factories Act for steam containers (vessels open to the atmosphere) and for air receivers are briefly given and discussed. W. H. C.

Distillation.

1276. Evaporation and Surface Structure of Liquids. G. Wyllie. *Proc. roy. Soc. A.*, 22.6.49, **197** (1050), 383.—The condensation coefficient (c.c.) of a liq is defined as the ratio of the observed rate of evaporation under given conditions to the "expected" rate calc from the known saturation v.p., for the same conditions. C.c. values of <1

have been criticised as to accuracy, etc. Apparatus for, and technique of, c.c. determination are described. The c.c. of glycerol was found to be 0·052 ± 0·005 at 18° C. In view of this result a review is given of published c.c. values for various compounds, which shows the c.c. is nearly equal to the free-angle ratio defined by Kincaid and Eyring. Chloroform does not show this equality. Theory of evaporation is discussed relative to a model liquid surface consisting of a compact ordered layer with a mobile adsorbed layer of mols above it. On the assumption that evaporating and condensing mols pass through the adsorbed condition, it is shown that the c.c. is determined by the rates of exchange between substrate and adsorbed layer, and adsorbed layer and vapour, respectively. If the exchange rate between the first pair is very much greater than that between the second pair, a c.c. near unity results. The above assumption does not satisfactorily explain the equality of c.c. and free-angle ratio for alcohol mols. This is discussed from the aspect of molecular structure and the reasons given.

W. H. C.

Absorption and Adsorption.

1277. Revision Program Completed at Old Ocean Unit Gasoline Plant. W. F. Bailey. *Oil Gas J.*, 19.5.49, **48** (2), 254.—The extensive revision programme at Old Ocean Gasoline Plant operated at Sweeny, Texas, by J. S. Abercrombie Co., is described.

350,000 million cu. ft. of gas are processed daily, yielding propane, *iso*butane, *n*-butane, gasoline, and stabilized crude.

Typical composite inlet gas-stream analysis shows that methane content varies from 86·4% (150 p.s.i.) to 92·58% (1800 p.s.i.) with ethane from 3·97% (1800 p.s.i.) to 7·42% (150 p.s.i.).

Tables give full analysis of inlet gases and plant balance, and a flow diagram gives equipment and processing details.

Storage facilities include two 5000-brl and one 10,000-brl spheres for natural gasoline, one 5000-brl sphere for *iso*butane, and various tanks for other products. G. A. C.

1278. Silsbee Gas-Processing Plant Performs Wide Variety of Functions. W. T. Bryant. *Oil Gas J.*, 19.5.49, **48** (2), 250.—The main processing section of the Silsbee plant operated by American Republics Corporation, Texas, is described.

The plant utilizes 100% of the field's available gas, and provides 4000 p.s.i. recycling gas, strips the gas used for gas lift and produces propane, butane, leaded and unleaded motor-fuel kerosine, normal seal oil, and yields gas for sale.

Approximately 125,000 g.p.d. of products are obtained from the incoming gases, which enter the plant at six diffierent pressures.

A flow sheet is given. G. A. C.

Solvent Extraction and Dewaxing.

1279. Combination Lube-Oil Plant. Anon. *Oil Gas J.*, 26.5.49, **48** (3), 98.—The propane-deasphalting and the phenol-extraction units of the Shell Oil Co. at Houston, U.S.A., refinery are described.

The former unit processes 4500 b.d. of reduced crude, and its product forms part of the feed to the 5800-b.d. phenol-extraction unit.

A feature of the units is the piping system, only sewers being underground.

The propane-treating tower is 50 ft high by 11 ft internal diameter, and operates at 500 p.s.i.g.

Heat for the phenol-extraction unit is supplied by a furnace specifically designed to heat 15,000 b.d. of extract solution to 550° F without cracking. G. A. C.

Cracking.

1280. 13 day Turnaround Achieved at Sinclair's Fluid Unit at Marcus Hook after Year's Run. Anon. *Oil Gas J.*, 9.6.49, **48** (5), 94.—The above 28,000-brl unit with a coke-burning capacity of 22,000 lb/hr was completed, overhauled, and back on full stream in 13 days.

This speed was attributed to outstanding design and organized planning of overhaul.

Features were appointment of the plant assistant master mechanic as job foreman

for 2 months prior to shutdown, installation of complete communication system including public-address system, and efficient material despatching and transport.

Condition of plant was good, and is detailed in article. G. A. C.

Special Processes.

1281. New Plant Converts Crude Petroleum Oils for Chemical Manufacturing Purposes. T. H. Bean and A. L. Vener. *Oil Gas J.*, 19.5.49, **48** (2), 307.—The nearly completed plant of Stanton Chemicals, Inc., at Corpus Christi, Texas, employs conventional refinery methods for completely converting crude petroleum oils from South Texas fields. Crude is passed to topping unit, and from thence fractionators produce various naphthas; the aromatic convertor gives benzene, toluene xylene, solvents, naphthalene, and anthracene. Residue treating produces lub. oils, greases, and asphalts.

Hydrolysis of olefin gases yields alcohols and plant fuel, and the oxidation unit produces glycols, naphthenic acids, insecticide actuators, and anthraquinone among other products. G. A. C.

1282. Primary Long Chain Alcohols—A new Petrochemical. P. W. Sherwood. *Oil Gas J.*, 9.6.49, **48** (5), 71.—The Oxo process for the synthesis of isomeric alcohols of high molecular weight and the Synol process for the production of the entire homologous series of straight-chain primary alcohols are discussed.

The Oxo process is now in use at Baton Rouge, and will be used elsewhere, but so far the Synol process has not been industrially developed.

The reaction mechanism of the Synol synthesis is not clearly understood, but thought to be somewhat similar to the Fischer-Tropsch mechanism.

A major problem is removal of heat from the reaction zone.

The Oxo process is non-selective, numerous alcohols being produced simultaneously. There are two stages in the process, the Oxo stage in the liquid phase to minimize side reactions, and the hydrogenation stage. Operation of the Oxo reaction takes place at 3000 p.s.i. Cobalt catalyst is used.

Applications of the long-chain alcohols should be as plasticizers and detergents, and products prepared from the alcohols include cutting oils, hydraulic fluids, and diesel oils of high Cetane Nos. G. A. C.

1283. Production of Chemicals by Oxidation of Natural-Gas Hydrocarbons. M. F. Wirges and J. W. Palm. *Oil Gas J.*, 12.5.49, **48** (1), 90.—A general discussion of methods of carrying out the oxidation reaction is given, together with a summary of data concerning the effect of the important variables on the reaction.

Basic steps are compression of reacting gases, preheating to desired temperature, reaction cooling and condensing, product separation, and product gas treatment.

Figures show the steps in the process, effect of per cent make-up on formaldehyde yield, and on make-up rate and formaldehyde production rate.

Operating variables discussed include pressure, temperature recycle, catalysts, and reaction time.

Tables show effect of pressure and make-up B.Th.U. on relative yield.

G. A. C.

1284. Shell Oil Completes $50,000,000 Petrochemical Plant Expansion. L. S. McCaslin. *Oil Gas J.*, 26.5.49, **48** (3), 64.—A review is given of the chemical plant of the Shell Oil Co., Inc., situated near Houston, U.S.A., and of its nineteen major products.

Construction of the plant was commenced in 1940, and in 1941 units produced *iso*propyl alcohol, acetone, and butadiene.

An allyl alcohol plant followed in 1945, and succeeding years saw epichlorohydrin, methyl *iso*butyl ketone, glycerine, and hexylene glycol produced, among other chemicals.

The plant was the first to produce synthetic glycerine, and will provide 15–20% of U.S. domestic consumption.

A special plant deals with the waste water from all the units. The principal products of the plant, and their uses, are listed. G. A. C.

Metering and Control.

1285. Cost-imating Instrumentation. W. L. Nelson. *Oil Gas J.*, 9.6.49, **48** (5), 101.—No. 34 in this series gives tables showing costs of installed instruments as percentages of the total process equipment cost, and approximate cost of black panel board.

Cost indices for various instruments from year 1928 to 1949 are also tabulated.

G. A. C.

Safety Precautions.

1286. Dust Explosions in Factories. Anon. *De Ingenieur*, 17.6.49, (24), G. 33–34.—The article draws comparisons between reports in *Engineering*, 30.6.48, 110, and *De Ingenieur*, 1948, (15), G. 36, in discussing the above subject.

It states that almost all organic and inorganic material in dust form is a potential explosive. Subdivided under three main headings as under are the industries in question.

(1) Industries producing and transporting a powdery product, *e.g.*, flour-mills.
(2) Industries using powder as a raw material, *e.g.*, bakeries.
(3) Industries raising dust during production, *e.g.*, mines, soap-works.

Methods of prevention, including constructions and ventilation, in such factories are mentioned. A. H. B.

1287. Control of Oil Fires. A. F. Dabell. *Proc. Instn mech. Engrs*, 1947, **156** (4), 381–384. (*Summary of an informal discussion held in* 1941, *publication having previously been prohibited for security reasons.*)—The principles underlying fire protection and fire fighting in the case of liquid fuels are enumerated, and protective practice in respect of storage tanks, retaining walls, pipelines, fire traps, flame arresters, and electrical transformers is outlined. The effect of oil on navigable waters is discussed, together with the specific properties of extinguishing agents. J. G. H.

1288. New Experience in the Fighting of Oil Fires. H. Brunswig. *Erdöl u. Kohle*, 1949, **2**, 193–199.—Experience gained in Germany during the 1939–45 war is discussed. It is considered that the type of product is a better indication of difficulty of fire quenching than the flash point, "impure" (*i.e.*, wide-range) products such as crude being much more difficult to deal with than more homogeneous fractions. The difficulty of fighting tank fires is inversely proportional to the height of liquid therein and increases approx as the cube of the fire duration. Foam is recommended for extinguishing fires in low-flash products, but the value of the cooling effect of water when dealing with burning heavier products is strongly stressed. A foam density of 0·15 (*i.e.*, a vol increase ratio of about 6·5) is recommended, and the foam should have a water loss $>50\%$ during the first 15 min. A min application of 0·5–1·25 m^3 foam per m^2 of burning area (depending upon the type of pet product in question) is required and should be attained within 15 min; these values are for permanent foam installations and require increase if foam is applied by other means. Types of German foam-supply equipment are briefly discussed, and photo-micrographs of foam structure are given. V. B.

PRODUCTS.

Chemistry and Physics.

1289. The Reaction of Atomic Hydrogen with Acetylene. E. L. Tollefson and D. J. Le Roy. *J. chem. Phys.*, 1948, **16**, 1057–1062.—The thermal dissociation of hydrogen on hot tungsten filaments has been used in the investigation of the reaction of atomic hydrogen with acetylene. A quantitative method has been developed for the detection of atomic hydrogen at pressures of the order of 10^{-3} mm. The catalytic effect of acetylene on the recombination of atomic hydrogen has been studied. In contrast with results obtained by the discharge-tube method, small amounts of hydrogenated products are formed. W. E. M.

1290. The Mercury Photosensitized Reactions of *iso*Butene. G. A. Allen and H. E. Gunning. *J. chem. Phys.*, 1948, **16**, 1146–1152.—An investigation has been made of the reaction of *iso*butene with mercury ($^3P_1$) atoms at 30° C. The mechanism is shown to be :—

$$i\text{-}C_4H_8 + Hg(^3P_1) \longrightarrow i\text{-}C_4H_8^* + Hg(^1S_0)$$
$$i\text{-}C_4H_8^* + i\text{-}C_4H_8 \longrightarrow 2i\text{-}C_4H_8$$

accompanied by the decomposition of the activated *iso*butene molecule in reaction-initiating fragments. It is suggested that the discrepancies between the results of this investigation and those of the earlier work of Gunning and Steacie may be due to the effect of impurities in the *iso*butene, since it is shown that small amounts of added propylene or acetylene affect the rate of the reaction. W. E. M.

1291. Steric Effects. II. General Equations. Application to *cis*- and *trans*-2-Butene. T. L. Hill. *J. chem. Phys.*, 1948, **16**, 938–949.—This paper presents a general discussion of steric energy, with particular reference to potential surfaces. The equations of Westheimer and Mayer are generalized in some respects, and the theory applied to the case of *cis*- and *trans*-2-butene in particular. W. E. M.

1292. Bond Energies of Hydrocarbons. L. Gero. *J. chem. Phys.*, 1948, **16**, 1011–1013.—A dissociation scheme for CO is studied giving the following thermo-chemical data : heat of sublimation of C into ^5S carbon atoms is 169·735 k.cal/mol ; average bond energy in diamond is 84·58 k.cal/mol ; the C–H bond energy in the CH_3 radical is 97·02 k.cal/mol ; the paraffinic C–C bond is 82·59 k.cal/mol ; the olefinic C=C bond is 145·12 k.cal/mol ; the rupture of successive bonds in methane requires 100·76, 97·36, 97·02, 97·02 k.cal/mol. W. E. M.

1293. Dissociation Schemes of Some Carbonyl Compounds. L. Gero and J. G. Valatin. *J. chem. Phys.*, 1948, **16**, 1014–1017.—Dissociation schemes and bond energies are given for formaldehyde, acetaldehyde, acetone, and ketene. W. E. M.

1294. Effect of Light on the Combustion of Hydrocarbons. R. G. W. Norrish and D. Patnaik. *Nature*, 1949, **163**, 883.—The slow combustion of hydrocarbons takes place by a chain reaction involving degenerate branching, in which the first step is the formation of a moderately stable intermediate. In the case of methane and ethylene this intermediate may be identified with formaldehyde. The complete scheme for methane oxidn is given, together with the kinetic equation derived theoretically and confirmed experimentally. Minor differences between the oxidn of methane and ethylene are accounted for.

Since free radicals are formed when formaldehyde is exposed to light, the combustion of methane and ethylene should be accelerated by light. The theoretical modifications to the kinetic equation have been computed, and the results have been experimentally confirmed. At 431·5° C the oxidation of ethylene was increased by *ca* 60% when irradiated by ultra-violet light, and the acceleration was suppressed when light of wavelength <3600 Å was cut out. The difference between the rates in light and dark is approx $\propto$ (hydrocarbon concn)^2 as required by theory, and the influence of maintaining a constant pressure is also explainable. These experiments are the more striking when it is remembered that the original reactants are completely transparent to the light used.

The characteristics of degenerate branching are similarly observed with heavier hydrocarbons, and aldehydes are again believed to be responsible. It is known that the oxidn of butane is readily affected by light. H. C. E.

1295. The Mercury Photosensitized Reaction of Dimethyl Ether. R. A. Marcus, B. de B. Darwent, and E. W. R. Steacie. *J. chem. Phys.*, 1948, **16**, 987–992.—At 25° C the products are mainly hydrogen and 1 : 2-dimethoxyethane, and the initial stage is shown to be the removal of a H-atom. At higher temp CH_3O, CH_4, C_2H_6, and probably $CH_3OC_2H_5$ become important products. They are derived from the decomp of the methoxy methyl radical followed by subsequent radical recombination reactions. Carbon monoxide is produced in the later stages from the decomposition of formaldehyde.

By varying the light intensity and pressure, it has been shown that ethane and dimethoxyethane are produced by second-order recombination of methyl and methoxy methyl radicals respectively. The following activation energies are estimated :

$$CH_3 + CH_3OCH_3 \longrightarrow CH_4 + CH_3OCH_2 \quad E = 9{\cdot}0 \text{ k.cal.}$$
$$CH_3OCH_3 \longrightarrow CH_3 + CH_2O \quad E = 19 \text{ k.cal.}$$

W. E. M.

1296. Heats, Equilibrium Constants, and Free Energies of Formation of *cyclo*Pentene and *cyclo*Hexene. M. B. Epstein, K. S. Pitzer, and F. D. Rossini. *National Bureau of Standards*, Apr. 1949, **42** (4), 379.—Values to 1500° K of heat-content function, free-energy function, entropy, heat content, heat capacity, heat of formation, free energy of formation, and logarithm of the equilibrium constant of formation for *cyclo*pentene and *cyclo*hexene in the gaseous state have been compiled. Free energies and equilibrium constants of a number of reactions involving isomerization, dehydrogenation, and disproportionation of these compounds have also been calculated. The latter results are shown graphically. A. S.

1297. Role of Formaldehyde in the Oxidation of Ethylene. A. J. Harding and R. G. W. Norrish. *Nature*, 1949, **163**, 797.—The reaction of oxygen and ethylene above 300° C shows characteristics of a chain reaction which proceeds by degenerate branching, and it is thought that formaldehyde is the important intermediate in the reaction. It is found that : (1) the concn of formaldehyde in a mixture of ethylene and oxygen rises to a max as the max rate is attained ; (2) its max concn is proportional to the ethylene concn. These results would be expected if formaldehyde gives rise to degenerate branching.

Further, the activation energies of ethylene and formaldehyde oxidation are as shown below :—

Temp. range, °C.	Ethylene, k.cal	Formaldehyde, k.cal
300–370	—	21
<400	26	—
450–470	42	39
550	53	>40

These results are in agreement with the idea that the degenerate branching process is identical with that by which the intermediate produces chains in its own oxidn.

H. C. E.

1298. Doubly Charged Ion Spectra in Mass Spectra of Hydrocarbons. F. L. Mohler, E. G. Bloom, E. J. Wells, J. H. Lengel, and C. E. Wise. *National Bureau of Standards*, Apr. 1944, **42** (4), 369.—The mass spectra of hydrocarbons and other polyatomic molecules in general reveal small peaks that arise from doubly charged ions. The Catalog of Mass Spectral Data of the American Petroleum Institute has been the source of data used in the compilation of doubly charged ions in the mass spectra of 148 hydrocarbons. The tables show that unsaturated molecules give larger doubly charged ion peaks than saturated molecules, while of the latter, with six or more carbon atoms double ionization with breaking of carbon bonds is most probable. In benzenes and highly unsaturated molecules double ionization without loss of carbon atoms is probable. An indication of the appearance potential of the ion is given by the ratio of ion current at 70 V to that at 50 V ionizing voltage. This increases with the number of hydrogen atoms removed, these being removed in pairs to give H_2. A. S.

1299. Carbon–Hydrogen Bond Strengths in Methane. H. H. Voge. *J. chem. Phys.*, 1948, **16**, 984–986.—This paper presents a consistent set of data for the energy levels of the carbon atom, the heat of sublimation of carbon, the dissociation energy of C–H, and the energies of successive removals of hydrogen atoms from methane. The latter figures are given as 101, 90, 80, and 80 k.cal, respectively. W. E. M.

1300. *Iso*tope Effect in the Thermal Cracking of Propane-1-C^{13}. D. P. Stevenson, C. D. Wagner, O. Beeck, and J. W. Otvos. *J. chem. Phys.*, 1948, **16**, 993–994.—The

pyrolysis of propane was studied in order to investigate the relative probabilities of dissociation of C^{12}–C^{12} and C^{12}–C^{13} bonds. Propane 1-C^{13} (53%) was cracked to a depth of approximately 10% and the products analyzed. It was found that the rupture of the C^{13}–C^{12} bond was 8% more frequent than the rupture of the C^{12}–C^{12} bond. W. E. M.

1301. The Mercury Photosensitized Polymerization of *cyclo*Propane. H. E. Gunning and E. W. R. Steacie. *J. chem. Phys.*, 1949, **17**, 351–357.—An investigation has been made of the polymerization of *cyclo*propane with mercury ($^3P_1$) atoms in a static system over the pressure range from 1 to 400 mm. at 30° C. The main product is a polymer with the formula $(C_3H_6)n$ where n is about 6. The proposed mechanism is as follows:

$$(1)\quad C_3H_6 + Hg(^3P_1) \longrightarrow (CH_2)_3^* + Hg(^1S_0)$$
$$(2a)\quad (CH_2)_3^* + C_3H_6 \longrightarrow 2C_3H_6$$
$$(2b)\quad (CH_2)_3 + C_3H_6 \longrightarrow (CH_2)_6^*.$$

Chain termination will occur when the polymer radical can no longer furnish sufficient energy to break the C–C bond in *cyclo*propane. The radical will then stabilize itself by a proton shift. W. E. M.

1302. The Energy of the C–H Bond in the Three Picolines (Methyl Pyridines). J. S. Roberts and M. Szarc. *J. chem. Phys.*, 1948, **16**, 981–983.—The pyrolysis of the three picolines was investigated, and the rates of decomposition were compared with the rate of the decomposition of toluene. It was found that the process was analogous to that of toluene, *i.e.*, the rate-determining step is the splitting of the picoline molecule into H atom and picolyl radical. The C–H bond energies were calc: α-picoline, 75·5 k.cal/mol; β-picoline, 76·5 k.cal/mol; γ-picoline, 77 5 k.cal/mol. It was concluded that the resonance energies of the benzyl and picolyl radicals are approximately equal. W. E. M.

1303. On the Thermochemistry of Organic Compounds. J. G. Valatin. *J. chem. Phys.*, 1948, **16**, 1018–1024.—The dissociation energy of CO and the role of the ^5S state of carbon are discussed. The following thermochemical data are presented and discussed: the energy required to rupture ethane into two methyl radicals is 82·78 k.cal/mol; the difference between the mean C–C bond energy in diamond and that in higher members of the paraffin series is 2·04 k.cal/mol; the energies required to rupture the double bonds in the following hydrocarbons are: 1-heptene, 145·43 k.cal/mol; 2-methyl-1-butene, 148·70 k.cal/mol; 1-pentyne, 198·67 k.cal/mol; acetylene, 194·28 k.cal/mol. W. E. M.

1304. The Hydrates of Natural Gas. Part. 1. Moisture Content of the Gas and the Constitution of the Hydrates. R. V. Romano, E. Pipparelli, and S. Gnisci. *Riv. Comb.*, Jan. 1949, **111** (1), 18–30.—The present state of knowledge on natural gas–hydrate formation is discussed. The influence of pressure and temp is considered. D. H. McL.

1305. Thixotropic Behaviour of Petroleum Jelly. A. de Waele. *Nature*, 1949, **163**, 774.—Further observations are made on the reversible change of consistency brought about by the slow and fast shear of petroleum jelly (Abstr. No. 833). Experiments under more precise conditions, by treatment of the jelly in a Weiner–Pfleiderer mixer followed by rigidity measurements in a parallel-plate plastimeter, confirm the previous qualitative results. Prolonged treatment in the Weiner–Pfleiderer mixer gives rise to the formation of liquid crystals. H. C. E.

1306. Combustion Study by means of Photo-Electric Cells. R. Vichnievsky and G. Monnot. *Rev. Inst, franç. Pétrole*, 1949, **4**, 130–143.—A review of various types of equipment that have been described in the literature. Circuit diagrams are given, and the characteristics of the various methods are critically discussed. Procedures described include, in addition to those for the detection of ignition within the cylinder, methods whereby the combustion temp is measured with the aid of photo-electric equipment. The authors themselves favour the use of a simplified type of electronic

pyrometer without external amplifiers, and in which the light beam emerging from the quartz cylinder window is divided and passed through red and green screens before impinging on the two photo-cells; the ratio of the currents produced enables the flame temp to be determined after the apparatus has been calibrated against a black body. V. B.

1307. Some Physical Chemical Properties of Aqueous Solutions of Soaps and Soapless Detergents. G. S. Hattiangdi, W. W. Walton, and J. I. Hoffman. *National Bureau of Standards*, Apr. 1949, **42** (4), 361.—Thirty typical commercial soaps and shaving-soaps and six popular synthetic soapless detergents were investigated with a view to discovering the effect of varying the concentrations of the soap solutions on surface tension, electrical conductance, pH value, opacity, and foam formation. Toilet "medicated," glycerin, coco, washing (laundry), and shaving-soaps were included. Various aqueous solutions of the soap or soapless detergent were prepared, and the data correlated with the structure and phase nature of the solid soaps as revealed by investigations with X-ray diffraction and electron microscopy and the significance of the results interpreted in terms of fundamental colloid chemical hypotheses. The significance of the results in terms of micelle formation and the relationship between micelles and detergent action are discussed in the paper. A. S.

Analysis and Testing.

1308. Bearing Strength Tests on Thermoplastics. J. W. Fogwell. *Mod. Plastics*, May 1949, **26** (9), 98.—Bearing strengths, the average stress in the plastic at which the deformation of the plastic is 0·2% of the dia of the hole in which the bearing pin is inserted have been determined on various samples of thermoplastics by directly measuring the deflection of the specimen in a Baldwin–Southwark machine using the 6000 lb range, and points were determined by plotting deflection against stress and noting the stress at the point where the set became 0·2% of the bearing-pin dia.

The bearing strengths of the various plastics are tabulated, and typical curves for materials examined shown in figures. G. A. C.

1309. Determination of the Amount of Moisture by the Fischer Method. R. Dalbert and J. Tranchant. *Chim. et Ind.*, 1949, **61**, 457–465.—A review, in which the theory of the method is discussed and the preparation of the reagents described. Both direct (visual) and electrometric titration methods are explained; the "dead stop end point" variation of the latter is alone considered. The use of the method in the determination of the moisture content of explosives is dealt with in some detail. Forty-four references. V. B.

1310. Instrumentation for Field Tests of Panel Heating. D. L. Mills, L. J. Latart, and F. W. Hutchison. *Heating Ventilating Engr*, Apr. 1949, **46** (4), 70.—Science of space heating by means of radiant panels has progressed to a point where fundamental design is thoroughly established. Questions of to-day pertain to comparisons of systems and to analyses of comparative first and operating costs. Requirements of a field programme for testing panel heating installations are: (i) the installation for test must be representative of average practice, (ii) the installation must be equipped with instruments of laboratory accuracy. Moreover, the instruments will usually have to be installed at the time the structure is erected to ensure normal-occupancy conditions. It is very difficult to satisfy both these conditions in practice. The article describes a structure which meets these requirements, and the projects selected for investigation are outlined. Test results are to be supplied in subsequent articles. Diagrams are given showing a typical floor plan for one of the rooms, the flow circuit (in simplified form) for each of the systems, and a cross-section through the slab in the room with 1-in depth of tube bury. A. S.

1311. Analysis of Mineral Oils by Physical-Chemical and Especially Spectroscopic Methods. H. Luther. *Erdöl u. Kohle*, 1949, **2**, 179–188.—An oil-analysis scheme comprises multiple vac dist at temp $\nearrow 275°$ C, solvent dewaxing using dichlorethylene–methanol and chromatography on alumina using an oil–adsorbent ratio of 1 : 1 to 1 : 2. Elution is carried out with pentane, toluene, diethyl ether (or acetone), and propanol.

Approx 3% of the oil is irremovable with pyridine. Chromatography gives better separation than either dist or solvent extraction. The eluted fractions, after removal of solvent, can then be examined by optical methods. The applicability of Raman analysis is discussed at some length, details of technique being given. It is considered that earlier views regarding the unsuitability of this method for the examination of higher hydrocarbons are unwarranted. Results of spectral analysis of three synthetic oils, before and after hydrogenation, are tabulated, and the interpretation of the results is discussed. The scope of such analysis is reviewed, and a rapid survey of physical methods of analysis is included. 137 references. V. B.

1312. New Method for the Accurate Estimation of Phenols in Low Temperature Tars and in Tar Oils. G. Lambris and H. Haferkorn. *Erdöl u. Kohle*, 1949, **2**, 238–240.—20% KOH solution is saturated with benzene and xylene and the HCl required (*b*) by 1 g of the solution determined, using N/5 HCl. A known wt (*a*) of the KOH solution is then shaken with a solution of the water-free tar in benzene–xylene. The bulk of the phenolate solution is separated and weighed (*c*). The remaining phenolate solution is separated from the tar solution, using hot water as the wash liquor, and the HCl required to neutralize this residual phenolate determined (*d*). The phenol content of the tar solution taken is then given by the expression

$$c - a + \frac{cd}{ab - d}.$$

The method has an accuracy of $\pm 1\%$ and is applicable to tar quantities as low as 1–2 g; if the tar contains water this must be first removed by dist with xylene. The quantity of KOH taken should be 50% in excess of theoretical. V. B.

1313. Oil Absorption: A New Assessment. E. Marsden. *J. Oil Col. Chem. Assoc.*, May 1949, **32** (347), 183.—A new statistical analysis of the oil-absorption results (B.S.S. method) shows that there are no significant differences due to the types of surfaces used for test. The surfaces tested were porcelain, ground glass, marble, and the pigments used included ferrite yellow, lithopone, and prussian blue. There are, however, wide differences between the results of operators when working on similar pigments, but a much closer agreement is obtained by an operator in repeating his own work. An adequate explanation of these phenomena seems to be given if it is assumed that oil absorption is the sum of an oil-coating term and an oil-adsorption term. The oil-coating term is dependent upon the number of touches of particle with particle, and its magnitude is affected by the technique of the individual operator. The oil-adsorption term is independent of the method of working.

Ferrites of increasing particle size have been prepared, and the oil-absorption results appear to confirm this theory.

A literature review on the subject is included. D. K.

1314. Pyrolysis of Poly*iso*butene (Vistanex), Poly*iso*prene, Polybutadiene, GR-S, and Polyethylene in a High Vacuum. S. L. Madorsky, S. Strauss, D. Thompson, and L. Williamson. *National Bureau of Standards*, May 1949, **42** (5), 499 (15 pages).—Poly*iso*butene, poly*iso*prene, polybutadiene, GR-S, and polyethylene in samples of 25–50 mg were subjected to pyrolitic fractionation in a vac of 10^{-4} mm of mercury at temp ranging from 300° to 475° C. The products of pyrolisis were separated into four fractions: (1) gaseous, volatile at −196° C, (2) liquid at −75° C, (3) liquid at 25° C, and (4) wax-like fraction volatile at the temp of pyrolisis. On analysis in a mass spectrometer the gaseous fraction was found in every case to consist of CH_4. The liquid fraction (2) gave a mass-spectrum characteristic for any given polymer. The mol. wt. of the wax-like fraction was shown to vary from 543 to 739 depending on the particular polymer. The mol. wt. was determined by the micro-freezing-point–lowering method. The results of the work showed that this method of pyrolitic fractionation and subsequent mass-spectrometer analysis can be used as a means of identifying the polymers. A. S.

1315. General Basis of the Refractometric Elementary (Ring) Analysis of Saturated Hydrocarbons. G. D. Gal'pern and I. A. Musaev. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1949, 542–551.—A discussion of the theory on which such methods are

founded. The Vlugter and Waterman method is examined in detail, and it is considered that it is strictly applicable only to series of pet fractions whose general type of structure is known, and that an arbitrary choice of a " standard " homologous series of polymerized hydrocarbons cannot be justified without supplementary data; although the shape of the curve $R = f(M)$, where R is the sp. ref. and M the mol. wt., can, in the case of a series of successive hydrogenated fractions, give information as to the type of structure concerned. V. B.

Engine Fuels.

1316. Combustion of a Drop of Liquid Fuel in Flight. G. N. Khudyakov. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1949, 508–513.—Laboratory equipment to determine the frontal resistance of burning and non-burning drops of fuel is described. For experimental purposes an artificial " drop " is formed by spreading a thin film of fuel over the surface of a 16-mm-dia metal sphere, which is spring-mounted in front of a measured jet of pre-heated air. Measurement of the sphere displacement is carried out by projecting its shadow on a screen. Using gasoline and kerosine, air pre-heat temp of 190° and 225° C respectively were required before steady combustion could be maintained. Resistance of the burning drop is considerably less than that of the non-burning, a reduction of approx 38% being observed for gasoline at an air velocity of 24 m/sec. For a burning drop there is an increase in pressure, at the rear of the drop, of 0·2–1 mm water as compared to a non-burning drop, and therefore, under otherwise idetical conditions, the former will travel farther. V. B.

1317. Fuel Anti-Knock Requirements. C. G. Williams. *Auto Engr*, June 1949, **39** (515), 246.—A general explanation of engine knock is given in the paper, which then goes to discuss the limits imposed by fuel anti-knock requirements on thermodynamic efficiency. During the 1939–45 war a great deal of work was done on aircraft engines to increase their knock-limited power, the chief method being by supercharging and use of fuels of high anti-knock value. The knowledge acquired in this respect is summarized. The petrol-supply position in the United Kingdom is discussed, together with plans for extensive refinery development to satisfy the home market. Various anti-knock test methods are described which indicate the difficulties of assessing a motor fuel. The chief factors affecting octane requirements are then discussed separately, and these include C.R., type of valves (overhead or side), carburettor and inlet manifold, mixture temp, mixture distribution and fuel injection, valve overlap, ignition advance, engine speed, coolant temperature, and combustion-chamber deposits. Temp sensitivity of motor fuels and the various types of hydrocarbons are also discussed. It is stressed that future development of the automobile engine requires close co-operation between engine designer and petroleum refiner similar to that existing in America. A. S.

1318. Effect of the Addition of Ethyl Alcohol to Gasoline from Arabian Crude. C. Padovani, V. Berti, and G. Leidi. *Riv. Comb.*, Nov.–Dec. 1948, **11** (7), 265–282.—The physical characteristics and engine performance have been studied of a gasoline from Arabian crude, with 5–10% ethyl alcohol added. The proportion of T.E.L. required to give the same O.N. with the various gasoline-alcohol mixtures has been determined.

The improvement in O.N. was about unity for each 1% of alcohol added. It is concluded that by the addition of 5–10% ethyl alcohol it is possible to make a 65 O.N. gasoline with a noteworthy saving of T.E.L. By the addition of lead, 70–74 O.N. can be obtained. D. H. McL.

1319. Precision of Fuel Rating, 1942 to 1946. D. B. Brooks and R. B. Cleaton. *A.S.T.M. Bull.*, Jan. 1949, **156**, 56–67.—A study of the precision of fuel rating of motor, aviation, and diesel fuels during the period under review was based on 18,957 ratings of 415 fuel samples tested on a monthly exchange system between member laboratories of the Co-operative Fuel Research Committee. Motor fuels were tested by the Research and Motor Methods, aviation fuels by the Aviation and Supercharge Methods, and diesel fuels by the Cetane Method.

While the precision of rating motor and diesel fuels decreased during the war, but

recovered during 1946, no material increase in the precision of rating aviation fuels has occurred in five years, with the exception of Supercharge rating at a fuel-air ratio of 0·095. Standard deviation now averages 0·4 octane unit for Research and Motor ratings, 2 performance numbers for Aviation and Supercharge (rich) ratings, and 1·4 cetane units for diesel ratings. J. G. H.

1320. The Fuel Problem in Gas Turbines. P. Lloyd. *Proc. Instn mech. Engrs*, 1948, **159** (41), 220–229.—The effects of recent developments and new applications in gas-turbine technology on fuel requirements are outlined, and the range of liquid fuels available is discussed. The combustion process is considered in relation to viscosity, initial and final volatility, analysis, and ash characteristics. J. G. H.

1321. Safety Precautions in dealing with Compressed Gas for Motor Fuel. A. Pignot. *Riv. Comb.*, Jan. 1949, **111** (1), 3–17.—Safety precautions and installations for bottling gas for motor fuel are discussed, and maintenance and proper usage of gas lines, bottles, and compressors are described. Statistical data on accidents connected with the use of compressed gas for motor fuel in France during the past eight years are given. D. H. McL.

Lubricants.

1322. What is Bearing Seizure? The Problem and its Answer. Anon. *Mech. World*, 3.6.49, **125** (3255), 645.—The object of lubrication and the results of lubrication research are discussed. It is shown that the high spots on one face of two metal surfaces may pierce the oil film and make contact with high spots on the other metal surface, and so cause seizure or welding of the two surfaces. The progress of seizure can be followed in a general way by friction measurements, and is shown in a graph. The curve first shows a fall in friction owing to a decreased viscosity of the oil through heating up. The friction then remains constant for a time until the onset of seizure, which is indicated by a gradual rise. At this point the rubbing surfaces will have extruded the thinned-out oil film and will be running on the boundary layer of oil. Frictional heat will gradually expand the bearings and the working clearances will be lessened. This will increase the bearing load and may accelerate the process of seizure. Whether the faces score and weld together depends upon a number of factors. With high-speed rubbing faces, scoring is likely. Certain harder-type bearing alloys may predispose the faces to the more serious type of seizure welding. Scuffing of gear teeth is defined. The running-in of new journals, gears, etc., is considered. Oils containing " dag " colloidal graphite are often used for running-in purposes. The sources of troubles affecting lubrication, *e.g.*, small particles of solids, and the technique of avoiding such, including cleanliness, are described. The latter and the use of " dag " colloidal graphite provide an answer to the seizure problem. W. H. C.

1323. The Hydrodynamical Theory of Film Lubrication. W. F. Cope. *Proc. roy. Soc., A.*, 7.6.49, **197** (1049), 201.—The equations of film lubrication are derived from the general equations of hydrodynamics assuming only that the motion is steady, and that it takes place between two surfaces which are both close together and nearly parallel in relative motion. Consideration of the relative magnitude of the various terms under typical conditions as measured in a bearing shows that they are of very unequal orders of magnitude, and that in particular the inertia terms in the momentum and the dilatation and conductivity terms in the energy equation can be neglected. It is shown that film lubrication is possible if, and only if, either the distance between the surfaces decreases in the direction of motion (the geometric wedge), or the density of the fluid decreases in the same direction (the thermal wedge). W. H. C.

1324. The Load-Carrying Capacity of Hydrodynamic Oil Films. A Review of Some Current Problems. (*Taken from a paper presented to the American Soc. Mech. Engineers.*) *Mech. World*, 20.5.49, **128** (3253), 587.—Theoretical studies indicate that the load-carrying capacity of a journal bearing should be infinite. This is not the case in practice, and under certain conditions of bearing operation the load-carrying capacity may become substantially zero. In the study of lubrication several criteria have been proposed for the load-carrying capacity of journal bearings, but with each one there are

certain limitations. In fact, it can be said that there is no single criterion for load-carrying capacity. Also in theory the viscosity of the lub. oil is assumed to be constant throughout the oil film. In practice, viscosity often varies widely with temperature and slightly with pressure. Since there is no satisfactory method of measuring the variation of viscosity within the load-supporting film, it is difficult to appreciate the variation of load-carrying capacity which is reduced with increase in temperature. The effect of surface conditions is also the subject of some controversy, and opinion is divided between smooth surfaces and those which are porous and honeycombed. The effect of load conditions is also discussed, as is the effect of speed conditions.

W. H. C.

1325. **Journal Bearing Lubrication and Design.** A. S. T. Thomson. *Proc. Instn mech. Engrs*, 1948, **158** (2), 250–254.—Results are summarized of an investigation on the effects of variations on bearing width and radial clearance on the operating conditions of centrally loaded clearance journal bearings, the bearing arc being kept constant at 120°. An earlier paper dealt with the effects of variations in bearing width and arc of embrace. The experimental results are compared with theoretical values modified by relevant leakage coefficients; the measure of agreement obtained indicates that theoretical values so modified may be used with confidence in design.

Experiments are described in which high-point contact at starting and stopping is eliminated by supplying oil to a groove in the loaded side of the bearing at a pressure sufficiently great to overcome the applied load. The effect of a groove on the loaded side of the brass under various conditions of lubrication is investigated. J. G. H.

1326. **Oxidation Behaviour of Hydrocarbons. V. Oxidation of Synthetic Lubricating Oils.** C. Kröger and A. Kaller. *Erdöl u. Kohle*, 1949, **2**, 240–245.—Oxygen-absorption tests were carried out (120° C) on three synthetic (one hydrogenated) lub. oils (visc 10–64 cp at 50° C). Considerable foaming was experienced with the non-hydrogenated oils. Data showing comprehensive tests on the oils before and after oxidn is given. Results indicate that O_2-absorption tests do not always rate the oils similarly to tests carried out in a test bearing (cf. Abstract No. 690). The O_2-absorption curve for the hydrogenated oil resembles that previously obtained for cetane. Oxidn products were separated into gases (mainly CO_2 with small amounts of CO and CH_4), volatile condensable products (mainly water with small amounts of lower fatty acids), and non-volatile products. Separation of the fatty acids in the latter (by fractionation of the methyl esters) indicated that the longest paraffin side-chain (*i.e.*, that first attacked) in the synthetic oils had approx 13 C atoms. Certain characteristics of the oils (sap. val., neut. val., an. pt., d) increase proportionally to the O_2 uptake, but the relation between O_2 absorption and such increase varies with different oils. The effect of organic additives (Cu nonylate, Cu butyrate, quinaldine, tin oleate, phenyl *iso*thiocyanate, β-naphthol, and β-naphthylamine) was studied. Cu butyrate and quinaldine were oxidn cat, whilst the remainder acted as inhibitors, the β-naphthylamine being by far the most effective, no O_2 absorption being detected after 10 hr. Whilst the O_2-absorption test rates the additives in the same order as the test-bearing procedure the efficacies varied as between the two methods. The difference between the cat activity of the Cu nonylate and the inhibitory action of Cu butyrate is independent of Cu content and must be ascribed to the acid radical. Comparison with the earlier work on oxidn of cetane shows that the additives can in the latter case behave quite differently, *e.g.*, Cu nonylate is a marked inhibitor of cetane oxidn, thus clearly demonstrating the influence of the material being oxidized on its inhibitor response, β-naphthylamine was, however, a strong inhibitor in all the tests. It is concluded that measurement of O_2 absorption is indicative of the behaviour of an oil in practice.

V. B.

1327. **Progress in the Science and Art of Lubrication.** E. V. Paterson. *Petrol. Times*, 8.4.49, **53**, 235.—A further review of recent developments in lubrication practices.

C. G. W.

1328. **Synthesis of Lubricating Oil from Chlorinated Paraffin Hydrocarbons using Friedel–Crafts Catalysts.** F. Christmann. *Erdöl u. Kohle*, 1949, **2**, 178–179.—A historical note dealing with earlier work (1924–27) in this field and published as an annotation to a previous paper by Kölbel (see Abstract No. 693). V. B.

1329. Synthetic Lubricants. A New Type of Oil Developed in the U.S.A. E. W. Steinitz. *Auto Engr*, May 1949, **39** (514), 193.—The results of road tests carried out by the Automobile and Industrial Research Station, London, on Ucon lubricants, are described. These synthetic lubricants, known as Ucon, or Prestone motor oils in the U.S.A., and as Ucon lubricants in Britain, are synthesized from petroleum hydrocarbon gases, but do not contain petroleum oils. They possess properties far in advance of the best petroleum lubricants. The properties of Ucon lubricants, LB. 140, LB. 300X, and LB. 400 are tabulated. The important properties are : low pour point and high viscosity index. Their Conradson carbon value is nil. The high viscosity index permits an oil of very low viscosity at ordinary temperatures to be used giving low frictional losses, it also maintains a higher viscosity than mineral oils, at combustion-chamber temperatures, which results in good film strength and less cylinder wear. Road tests with a new Austin car were run for 12,000 miles, without change of oil, Ucon LB. 300X being used, the X denoting an inhibitor. An extra gallon was used for topping up. After the test the combustion chamber had a very slight covering of loose carbon, the camshaft housing was clean, and less than 0·001 inch wear was measured in the cylinders. No wear was found on the camshaft, bearings, and journals. Piston-rings were clean, and no sludge was present. The oil was still transparent after the test. Deterioration, after 4, 8, and 12 thousand miles showed Conradson carbon values of 0·03, 0·1, 0·15, and percentage increase in viscosity was : 7, 12, and 15 respectively. With mineral oils the Conradson carbon would be at least ten times greater, and increase in viscosity 100% greater. The photographs show the condition of engine parts after the test. W. H. C.

1330. Used Engine Oil. E. V. Paterson. *Auto Engr*, June 1949, **39** (515), 231.—Oil deterioration in a road-vehicle engine is result of : (i) contamination unrelated to type or quality of oil ; (ii) contamination due to oxidation and decomposition of oil. Former includes road grit, water from leaky joints, fuel dilution, carbon from incorrectly burned fuel, metal particles due to wear and tear. Solid matter or oxidation cause rise in viscosity and fuel dilution causes a reduction. Engines on short runs tend to suffer from fuel dilution and this should not be greater than 10%, otherwise oil viscosity will be reduced beyond safety limit. In oil engines 3% fuel dilution should be quickly investigated. Water content greater than 0·5% indicates mechanical defect. Water causes sludge formations and rapid oxidation. Carbon in oil comes from the fuel or the oil itself. Fuel carbon is not dangerous in small quantities. Excessive quantities of fuel soot indicate incomplete combustion. Asphaltic material is due principally to oxidation of oil and is found in an engine working under very heavy loads. It should not exceed 0·5%. High lead content in the ash generally indicates bearing failure unless leaded petrol is being used. Additive depletion should also be checked. Generally speaking used-oil analysis will probably confirm or disprove theories about mechanical defects. A. S.

Bitumen, Asphalt, and Tar.

1331. Road-mixed Bituminous Mat Built with Two Stone Sizes. G. B. Major and E. H. Logan. *Rds and Streets*, May 1949, **92** (5), 53.—Increased efficiency in mixing and a saving of 20% in bituminous material was attained by combining " plus ⅜ in " and " minus ⅜ in " stones, in the preparation of 10 miles of bituminous mat in County Johnson, Missouri. It was previously found that 80% of " ⅜ in plus " and 20% of " minus ⅜ in " gave a stone, the grading of which met the standard specification for a bituminous mat. The " plus ⅜ in " stone was placed in windrows on the road at the rate of 10 tons per 100 ft. These windrows were then flattened out by a motor grader for a width of 10 ft and S.C.4-cutback at 210° F applied at the rate of 6 gal/ton. After some manipulation with motor graders, further S.C.4 was applied at the same temperature and a rate of 4 gal/ton. This was all manipulated until coating was complete. 2·5 tons of " minus ⅜ in " stone per 100 ft was then spread, and mixed by a revolving tooth-harrow. By this procedure " balling up " was eliminated. The third application of S.C.4, again at 210° F, and this time at the rate of 3·2 gal/ton was made, the whole harrowed and bladed, and finally rolled to a thickness of 1¼ in for a width of 20 ft. R. H.

Special Hydrocarbon Products.

1332. Liquid Paraffin. V. Biske and Evelyn M. Biske. *I.P. Review*, May 1949, **3** (29), 146.—Liquid paraffin was first used internally in the United States in 1872, and was first included in the British Pharmacoepia in 1898. Its use has been criticised due to suspected carcinogenicity, but this has not been generally proved. Various medical uses and abuses are described. It has been used to some degree in the food industry, *e.g.*, baking, but its use is not always approved by the various authorities. Details are given of the legal aspect. General recommendations are made for the use of paraffin oil. R. H.

1333. Use of Wetting Agents Against Heath and Undergrowth Fires. J. F. Fry and P. M. T. Smart. *Nature*, 1949, **163**, 844.—Three series of experiments were made on ling, bracken, and purple moor grass: (1) extinction of fire; (2) prevention of spread of fire; (3) wetting of materials at normal temperature. One non-ionic and two anionic wetting agents were tested.

In (1) the use of a 0·2% solution did not show any difference to that of water alone. In (2) double the amount of water was required if no wetting agent was present. In (3) little difference was shown between water and 0·2% solution. It is concluded that whereas wetting agents have no value in fire extinction they may be of use in wetting the unburnt materials ahead of a fire. H. C. E.

Derived Chemical Products.

1334. Reinforcing Furnace Blacks. D. Parkinson. *Trans I.R.I.*, 1949, **24** (6), 267–273.—The channel and furnace processes for the manufacture of carbon black are briefly contrasted, and the properties of reinforcing furnace and channel blacks compared in rubber. It is concluded that although the finer furnace types, and particularly those made from oil, are difficult to process owing to a high rate of scorch, they impart properties to vulcanized rubber at least equal to those produced by the channel blacks. Possible factors influencing the high reinforcing value of the furnace blacks are briefly discussed. (Author's abstract.)

1335. Removal of Impurities from Synthetic *iso*-Propyl Alcohol. A. S. Nekrasov and B. A. Krentzel. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1949, 552–556.—Synthetic *iso*propanol obtained by the sulphuric-acid hydration of cracking gases contains as impurities di-*iso*propyl ether, polymerized hydrocarbons, and O and S compounds. Successful refining of the crude alcohol (d 0·820, n_D^{18} 1·3775, strong odour) was accomplished by vapour-phase treatment with an activated alumino-silicate cat of the type used for reforming and sulphur removal in the case of pet products. Treatment temp is crit to avoid ether formation and 95–105° C is optimum. Using 85 ml of finely divided (3 mm) cat a flow rate of 100 ml/hr gave good results. Alcohol loss was 1·5–2%, whilst the S content was reduced from 0·1 to 0·0%. The redist product gave a clear solution with water and had good odour. V. B.

Coal, Shale, and Peat.

1336. Dispersibility of Coal in a Supersonic Field. N. Berkowitz. *Nature*, 1949, **163**, 809.—When the pyridine-insoluble (α) fraction of a Northumberland coal (82·6% C, 5·1% H on dry, ash-free basis) was suspended in dry pyridine and exposed to supersonic waves for 15 min it was partially dissolved or dispersed. The extract thus formed was, after removal of the solvent, a black, free-running solid, the elementary composition of which was practically identical with that of the original α-fraction. The same result was obtained with the α-fractions of several other coals.

It appears that the quantity of material which can be extracted from a coal varies with the total energy that is available for the detachment of molecules or micelles. The experiments suggest that supersonic waves bring about a dispersion of micelles. Since the coal extracts possess colloidal properties and the extract formed in a supersonic field is almost insoluble in pyridine, it would appear that coals simulate thixotropic substances. H. C. E.

1337. Fischer–Tropsch Synthesis viewed as a Coal-Enriching Industry and as a factor in Energy Production. H. Paul and H. Tramm. *Erdöl u. Kohle*, 1949, **2**, 229–237.—

Capacity of Fischer–Tropsch installations in 1944 is tabulated, and energy balances for the normal and medium-pressure processes given. The best means of meeting the energy requirements of the latter are outlined. Utilization of the residual gas as an adjunct to the gas grid and as a means of meeting the winter peak loads of the gas industry is discussed. The general place of the Fischer–Tropsch process in German industry is pointed out, and a chart showing the many products from the iron medium-pressure Fischer–Tropsch synthesis included. V. B.

1338. Composition of Peat-Tar Components. L. Sh. Radzhabov and V. A. Lanin. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci*, 1949, 538–541.—Extraction of peat-tar with pet ether, and subsequent separation of the phenols, acids, and bases from the extract showed a yield (on the tar) of approx 65% of total neutral oils + wax. Further breakdown of the individual groups (including the insol portion) gave the following as the main components of peat tar (%): neutral oil 16, wax 25, phenols 8, bases 1, unstable oils (*i.e.*, polymerizing on silica gel) 23, neutral asphaltenes 6, asphaltic. phenols 8·5, water 6·5. Tabulated results of peat-tar analyses by four methods show reasonable agreement. V. B.

Miscellaneous Products.

1339. Glycerin—Man's Most Versatile Chemical Servant. M. A. Lesser. *Chem. Education*, June 1949, **26** (6), 327.—Most of glycerin available to-day is obtained as a by-product of the soap industry, where it is separated by saponification of fats and oils. Some is obtained more directly by fat-splitting processes. It has a large number of uses in industry, the largest consumption going to the production of synthetic resins and ester gum. Other uses are production of nitroglycerin, drugs, textile processing, manufacture of chemicals, anti-freeze fluids, hydraulic fluids, liquid coolants, lubricants, products for insect and micro-organism control. Glycerin can form esters, ethers, inner ethers, acetals, amines, halohydrin, and metallic derivatives. Esters are most important of glycerin derivatives, and include nitroglycerin, alkyd resins, ester gum, acetins, and long-chain fatty derivatives. A. S.

1340. The Structure of Pigments. Anon. *Paint Technol.*, June 1949, **14** (162) 247.—A brief discussion is given on the little knowledge that is available concerning pigments. Lithopone is prepared by a simple chemical reaction. Two possible mechanisms are suggested: (1) ZnS and $BaSO_4$ are precipitated side by side as discrete particles, or (2) composite particles are formed, one forming a skin over the other. The former mechanism is favoured.

Pigment dyestuffs are insoluble organic particles, probably crystalline in nature, but few data are available for study. It is believed that colour and tonal values of dyestuffs vary according to conditions of precipitation. This suggests changing conditions cause changes in particle growths. Differences observed may also be caused by differences in surface due to material adsorbed on the surface from the liquor. These dyestuffs are often sold diluted with extenders such as $BaSO_4$. The action of the extender is considered.

Lakes are essentially soluble dyestuffs reacted with a substance capable of rendering them insoluble (usually an inorganic base). The possible structure of the resulting lake is discussed. It seems that in a colour lake of the type formed by a barium salt of an acid dyestuff precipitated in the presence of H_2SO_4, $BaSO_4$ is also precipitated. Three types of particle exist side by side, *i.e.*, a true barium dyestuff compound, $BaSO_4$, and coloured $BaSO_4$. The formation of mixed salts of $BaSO_4$ and dyestuff is considered unlikely.

The structure of rosinated colours is considered. All the forms described under lakes may be present plus barium rosinate. Here possibility of formation of mixed salts exists. Speculation on the action of rosin when incorporated into materials is included. D. K.

Engines and Automotive Equipment.

1341. Aeroplane Gas Turbines. H. Constant. *Proc. Instn mech. Engrs*, 1947, **157** (29), 202–204.—A statement of the prospects of the gas turbine as a power unit for aircraft. J. G. H.

1342. American Aircraft Propulsion Machinery. W. J. King and W. R. Hawthorne. *Proc. Instn mech. Engrs*, 1947, **157** (29), 197–202.—A survey of current piston- and turbine-type aero-engines, with performance and construction data for individual models and notes on future trends. J. G. H.

1343. American Road Transport Gas Turbine. Anon. *Gas Oil Pwr*, 1949, **44**, 126.—Model 502 made by the Boeing Aircraft Co. develops up to 200 h.p. and weighs about 150 lb. It comprises a single-stage centrifugal compressor, two constant-pressure burners, a primary turbine driving the compressor, and a power-output turbine with reduction gear. The power turbine gives its rated output at 24,000 r.p.m.

Gases enter the primary 8-in turbine at 1500° F and leave the secondary 10-in turbine at 1000–1100° F. Kerosine, diesel oil fuel, or furnace oil can be used as fuels, and the specific fuel consumption is expected to be 1·5–1·0 lb/b.h.p. H. C. E.

1344. American Marine Gas Turbines. E. S. Dennison. *Motor Ship*, June 1949, **30** (94), 353.—The author reviews three 3000-h.p. units now building for the U.S. Maritime Commission and Navy. I. G. B.

1345. Aviation Gas Turbines. S. A. W. Thompson. *I.P. Review*, May 1949, **3** (29), 129.—Main difference between gas turbine and piston engine is in former the combustion process is continuous, while in latter it is intermittent. In gas turbine air is compressed, passed to combustion chambers, fuel is injected, and burnt gases expand partially through a turbine and finally through jet pipe. The turbine drives the compressor. Thrust obtained is reaction of jet of gases issuing from tailpipe. Idea of gas turbines has been known since seventeenth century, but only recently have they achieved practical possibilities. First turbine engine to be used successfully in flight was Whittle engine. Since then considerable development has been made. Chief disadvantage is low thermal efficiency, although there are many advantages at high speeds and altitudes. Variations of the power plant are possible—*e.g.*, (1) straight jet; (2) propeller-turbine—the choice depending on requirements. In latter the turbine not only drives compressor but also a propeller, so smaller amount of energy is available as thrust from jet pipe. Latter has higher propulsive efficiency at lower speeds. Either centrifugal or axial compressors can be used, although the latter are becoming more widely used. In future the use of propeller–turbine plant in large low-speed aircraft and possibly heat exchangers to improve fuel consumption are indicated. A. S.

1346. Performance of Axial-flow Turbines. D. G. Ainley. *Proc. Instn mech. Engrs*, 1948, **159** (41), 230–244.—The development of the aerodynamic design of gas turbines from that of steam turbines is described, and recent work on cascade tunnels and gas flow in an actual turbine stage are outlined. The technique of full-scale turbine testing is discussed, with details of power absorption, instrumentation, and safety measures. The effects of errors in measurement are also considered. J. G. H.

1347. Contribution to the Solution of the Gas Turbine Problem. A. J. R. Lysholm. *Proc. Instn mech. Engrs*, 1947, **157** (36), 498–523.—A general survey of gas-turbine development up to 1932 is followed by detailed descriptions of the development of the Bofors turbine, the Ljunström turbine, and the Elliott–Lysholm turbine.

J. G. H.

1348. Some Notes on the Design, Development, and Production of High-Speed Compression-Ignition Engines. S. Markland and N. Tattersall. *Proc. Instn mech. Engrs Auto. Division*, 1947–8, (1), 9–29.—The present type of direct-injection engine is the outcome of prolonged research dating back to the late 1920s. Details are given of fuel consumption and performance characteristics of such an engine installed in a road vehicle, and the reasons for the high efficiency so obtained are outlined. Factors involved in the dimensions and arrangement of the auxiliaries are discussed, together with the mechanical design of crankshafts, bearings, cylinder castings, pistons, connecting-rods, and valves. The selection of the appropriate type of injector nozzle for a particular combustion chamber is described in detail. The lubrication system, detergent oils, cold starting, and " running in " are also dealt with. J. G. H.

1349. Development of an Axial Flow Gas Turbine for Jet Propulsion. D. M. Smith. *Proc. Instn mech. Engrs*, 1947, **157** (36), 471–472.—The technical developments of the F2 jet-propulsion engine are reviewed from the original discussion in 1937. The preliminary models are described and illustrated, and the development of the individual components is discussed. J. G. H.

1350. Development of Gas Turbine Power Plants for Traction Purposes in Germany. R. H. Bright. *Proc. Instn mech. Engrs*, 1947, **157** (34), 375–386.—Details are given of German investigation into the possible applications of gas turbines to land-traction units. The steps of development are outlined from a single turbine employed for driving the compressor and performing the actual work, through separate turbines with individual and combined combustion chambers, to the two turbines in series with a single heat exchanger. Power-transmission problems are discussed, together with design details and the construction of main components. J. G. H.

1351. Development of Variable Specific Heat Charts and Graphs, and their Application to Internal Combustion Motor Problems. W. J. Walker and C. Rogers. *Proc. Instn mech. Engrs*, 1948, **159** (42), 301–312.—A method of investigation into problems relating to internal-combustion-motor design and performance using analytical and graphical features is described. A chart is provided which, with the aid of auxiliary graphs, enables theoretical indicator diagrams to be constructed for any internal-combustion-engine cycle under conditions of variable specific heat; it can also be used for studying indicator diagrams obtained under test conditions.

The main feature of the chart is the provision of means which enable it to be used for any hypothetical or initial conditions encountered in practice; auxiliary graphs facilitate the calculation of thermal efficiency, mean effective pressure, and other essential quantities.

Illustrative examples of the use of the chart and graphs are presented for the dual-combustion cycle, diesel cycle, and constant-volume cycle. J. G. H.

1352. Two-Phase Fuel Injection. Anon. *Gas Oil Pwr*, 1949, **44**, 102.—A new system of pilot-fuel injection is described which is claimed to lower the rate of gas-pressure rise, reduce diesel knock, and lessen combustion noise. Injection begins at a low rate covering the delay period, and the rate then increases over the second half of the injection period. This effect can be achieved by employing a two-step pump cam.

The injector has been modified to ensure that the pressure at which the first-stage injection takes place can be made low enough to provide adequate control even at the point of closure. The difference between the conventional valve nozzle and that of the new type is that in the latter closing of the valve is not affected by fall in pressure of the fuel in the space communicating with the nozzle holes, but by a pressure drop in a supplementary space temporarily isolated from the nozzle holes by closure of a non-return valve. Pressure at the nozzle holes is thus maintained at a sufficiently high level until the final closure. The setting up of pressure waves, which are sometimes great enough to reopen the nozzle of a conventional type valve, is avoided by a special design of pump valve. H. C. E.

1353. Fuel Systems for the Aero-Gas Turbine. E. A. Watson. *Proc. Instn mech. Engrs*, 1948, **158** (2), 187–208.—An account is given of problems associated with the development of fuel systems for aero-gas turbines, the subject being considered from two aspects—the supply of fuel in the appropriate quantity and atomization of the fuel preparatory to its evaporation and combustion.

The effects of altitude, inlet temperature, speed, and combustion efficiency on fuel consumption are discussed, and the general principles of fuel-control systems outlined with illustrative installations. The basic principles and methods of operation of the atomizer are described, and data are presented on the principal types at present available. J. G. H.

1354. The Gas Turbine as applied to Marine Propulsion. T. A. Crowe. *Proc. Instn mech. Engrs*, 1948, **158** (1), 103–116.—An historical survey is presented of gas-turbine development with brief summaries of the constant-volume and constant-pressure principles. Data are included on air heaters, heat exchangers, materials of construc-

tion, and control systems. Requirements for marine service are enumerated, and typical marine installations are described. The necessity for the gas turbine having a fuel consumption close to that of the diesel engine, and being capable of burning the cheaper grades of boiler oil is stressed, and it is concluded that a growing practical experience will establish the reliability of the gas turbine as a fundamental unit in marine propulsion. J. G. H.

1355. Heat Flow in the Gas Turbine. A. G. Smith. *Proc. Instn mech. Engrs*, 1948, **159** (41), 245–254.—Experimental data are presented on turbine-blade heat transfer. The reaction between blade stagger, Nusselt number, and Reynolds number is examined, and a method proposed for the approximate estimation of Nusselt number by Reynolds analogy. The experimental data obtained are used in the calculation of heat flow in blades cooled at the root, and in internally cooled blades.

Heat exchangers are discussed, and the advantages of the regenerated type are stressed; relevant data on heat transfer in laminar flow are also presented. J. G. H.

1356. New Continental Small High-Speed Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 120.—The Samofa-Harderwijk engines have either one or two cylinders and develop 10 and 20 b.h.p. respectively. They are designed mainly for agricultural and civil-engineering use. The main frame is a single casting which forms the cylinder block, crankcase, and bed-plate. The crankshaft of the two-cylinder engine has no central bearing, and power may be taken from either end of the engine by transfering the flywheel. Direct injection is employed, and the open combustion chamber and injection arrangements follow the Gardner practice. An oil-pump supplies lubricant for the main engines, crankpins, layshaft bearing, and rockers, while the camshaft bearings are fed by oil flowing down from the overhead-valve gear.

Two diagrams illustrate the article. H. C. E.

1357. An Investigation of the Airbox Method of Measuring the Air Consumption of Internal Combustion Engines. L. J. Kastner. *Proc. Instn mech. Engrs*, 1947, **157** (34), 387–404.—The significance of air consumption in the performance of internal-combustion engines is discussed, and methods employed for its measurement are enumerated. The airbox method is described in some detail, and the results of recent investigations on the amplitude of the pressure fluctuations occurring in boxes of inadequate size, with data on the errors in measurement produced thereby, are presented, and the essential factors governing the design of an effective airbox meter are discussed. J. G. H.

1358. Oil Engine and Steam Engines for Marine Propulsion. P. L. Jones. *Proc. Instn mech. Engrs*, 1947, **157** (29), 171–174.—The application of oil engines to marine power plants is considered generally; special points discussed include supercharging, cooling, gearing, and the use of heavier and cheaper grades of fuel oil. J. G. H.

1359. Part-load Performance of Various Gas-Turbine Engine Schemes. D. H. Mallinson and W. G. E. Lewis. *Proc. Instn mech. Engrs*, 1948, **159** (41), 198–219.—While the literature on gas turbines already contains a considerable body of data on the performance of the "constant-pressure" cycle, both in its simple and more complicated forms, enabling the design performance of a particular engine to be estimated, there appear to be few data available to facilitate the estimation of changes in performance when particular engines operate at non-design conditions.

The present paper presents a general comparison of part-load performance characteristics, both of the simpler and more complex turbine engines, with land and marine applications. The influence of changes in the assumed component performance features in the part-load operation of an engine is considered, and guiding principles are put forward by which the comparative part-load performance of different gas-turbine schemes may be assessed. J. G. H.

1360. Piston Aero-Engines. H. R. Ricardo. *Proc. Instn mech. Engrs*, 1947, **157** (29), 193–197.—A general survey of the development of the piston aero-engine for military purposes during recent years. Points discussed include fuel developments, cooling, sleeve valves, fuel injection, and superchargers. J. G. H.

1361. Measuring Piston Ring Wear to One Millionth Ounce. Anon. *Auto. Ind.*, 1.1.49, **100** (7), 39.—A pictorial description of the method of measuring piston-ring wear by the use of radioactive rings and the employment of Geiger counters to measure the amount of radioactive metal worn off the rings and measured in the lub. oil in the laboratories of the California Research Corpn. J. G. H.

1362. Prospects of Land and Marine Gas Turbines. H. Constant. *Proc. Instn mech. Engrs*, 1948, **159** (41), 191–197.—The bias of gas-turbine development towards aeronautical applications is discussed, and technical problems incident to the development of land and sea turbines are enumerated. Applications to railway locomotives, power-stations, road transport, and marine engines are outlined, and the possibilities of standardization of components are considered. J. G. H.

1363. Some Aspects of Petrol Injection Equipment Development. K. Brook and W. E. W. Nicolls. *Proc. Instn mech. Engrs Auto. Division*, 1947–8, (1), 30–50.—Petrol-injection developments over the past ten years are reviewed, and the advantages of petrol injection are outlined. Operating speed, leakage and lubrication, pump output, helix design, and balance of output are discussed, together with general design features. Some typical pumps and injectors are described, and the mixture-control mechanism outlined. It is concluded that, while the petrol-injection engine affords decided advantages, the scarcity of reliable evidence of operation under service conditions has so far made it doubtful whether the effort involved is really justified. J. G. H.

1364. Steam and Gas Turbines for Marine Propulsion. T. W. F. Brown, S. S. Cook, and F. W. Gardiner. *Proc. Instn mech. Engrs*, 1947, **157** (29), 175–183.—A general view is presented of the present position of steam and gas turbines for marine propulsion. The gas-turbine section outlines possible advantages and discusses the lines of development being pursued, with particular reference to the open-cycle gas turbine, utilizing all-rotary turbines and compressors. Transmission systems, manœuvring arrangements, and possible lines of future progress are dealt with. J. G. H.

1365. Experimental Spark Ignition Engine. F. Picard and L. Thaler. *Rev. Inst. franç. Pétrole*, 1949, **4**, 180–189.—A new single-cylinder engine (I.F.P.–Renault) for multiple test purposes on fuels, lubricants, combustion, and engine performance, designed by a committee representing the French automobile industry and various research organizations, is intended to reflect present-day French automobile engine practice, typical examples of which are listed. Principal characteristics are: bore 80 mm, stroke 120 mm, 4500–5000 r.p.m., 500 cc capacity, variable C.R. (4·5/13), supercharge up to 2 kg/cm^2. Inclined overhead valves operated by overhead camshaft and wet liners are fitted, and different types of cylinder head are available. A triple carburettor permits rapid fuel changes, and alternative lubrication systems are provided for experimental purposes. Load is taken by a dynamotor. The principal characteristics of other test engines (U.S.A., British, German) are given for comparison. Two prototypes of the I.F.P.–Renault engine are in operation, and a certain number are about to go into production. The test-bench accessories which it is proposed to use with the engine are briefly outlined. V. B.

1366. Theoretical Investigation into the Porting of a Two-Cycle High Mean Effective Pressure Internal Combustion Engine. G. Parker. *Proc. Instn mech. Engrs*, 1947, **157** (34), 367–374.—An attempt is made to determine mathematically the sizes of ports and their timing in order to attain a mean effective pressure of the order of 200 p.s.i. in a two-cycle engine of the half-stroke sleeve type. The unknown factors which effect the accuracy of results so obtained are pointed out and discussed. No attempt is made at engine design other than the determination of port sizes and timings against a hypothetical manifold pressure. J. G. H.

1367. Chart for the Investigation of Thermodynamic Cycles in Internal Combustion Engines and Turbines. J. M. Gilchrist. *Proc. Instn mech. Engrs*, 1948, **159** (43), 335–349.—A method is presented by which, using a suitable selection of scales, the temperature–internal energy graph can be used to indicate enthalpy, engine expan-

sions, etc. In the case of turbine and turbo-compressors the heat drop, velocity changes, etc., are given by readings from the graph. The method is applicable to a general cycle, comprising Otto, diesel, Atkinson, Humphrey, etc., cycles, enabling the work done and efficiency to be read off without calculation.

Internal-combustion-turbine cycles are discussed, and the advantages of stage reheating and intercooling emphasized.

Energy–mixture strength tables for temperature intervals of 200° C are presented for mixtures between 100% weak and 20% rich. J. G. H.

1368. Three-dimensional-flow Theories for Axial Compressors and Turbines. A. D. S. Carter. *Proc. Instn mech. Engrs*, 1948, **159** (41), 255–268.—Three-dimensional flow in axial compressors and turbines is analyzed as a means of providing data for improved performance.

The origin of secondary flow is first examined, and the physical nature of the flow and theories facilitating the framing of quantitative estimates are discussed. Three-dimensional flow in an annulus with a stationary-blade row is considered, and attention directed to the influence of radial equilibrium on the flow pattern. The major factors governing the three-dimensional flow in an actual machine are then investigated, and and the empirical factors used in design are discussed and the relationships between them established. J. G. H.

1369. The New Werkspoor-Lugt Two-Stroke Diesel. F. G. van Asperen. *Mech. World*, 15.4.49, **125** (3248), 416.—In the field of large, slow-running marine engines, the four-stroke system is in decline and the two-stroke engine is increasing in favour, especially with the application of a supercharger. G. J. Lugt concentrated on idea of developing an engine which would be the most economical in every respect. The new engine should operate on heavy fuel. Uniflow scavenging is selected for various reasons. Other features include double-acting reciprocating air-pumps, exhaust-gas turbine, beam-driven scavenge pump for each working cylinder (the beams for conducting piston-cooling oil to and from the piston), and exhaust valve-gear drive from the top of the extended piston rod of the scavenge pump, elimination of cam-shaft, control of four exhaust valves by two pull rods. Alternative types of high-pressure fuel pumps have been developed, one mechanically operated and the other pneumatically driven. Fuel-injection pressure increased during injection period, while air pressure remained constant. Operates on same heavy fuel as "Auricula." Valve in cooling-water circuit coupled to fuel-control lever automatically regulates quantity of cooling water in accordance with heat to be transferred at different loads. A self-cleaning separator has been developed which can be employed for both purfying and clarifying purposes at the same time. Sludge is drained off continuously. A. S.

MISCELLANEOUS.

1370. Oil and the Marshall Plan. H. Ballande. *Bull. Assoc. franç. Tech. Pétrole*, 1949, (75), 3–24.—A general description of the Marshall plan, illustrated by numerous diagrams showing the organizations involved. Special reference is made to France and French oil requirements, and a diagram is given showing the mechanism whereby the importer, French government, and E.C.A. are linked for the acquisition of materials such as pet and pet equipment. V. B.

1371. From "Testing Station Delft" to "Royal Dutch Shell Laboratory, Delft." Anon. *Ingenieur*, 27.5.49, (21), A201–202.—The article describes the reasons behind changing the name of the above and is illustrated by two photographs of apparatus which are mentioned in connexion with the changeover. A. H. B.

1372. Banning of Fischer–Tropsch Factories. Anon. *Erdöl u. Kohle*, 1949, **2**, 253–255.—A discussion, in the form of a memorandum issued by the German Coal-Mining Administration, demonstrating the significance of the Fischer–Tropsch process in German and West European economy and stressing the ill-effect of the ban on German industry and employment generally and on the coal-mining industry in particular. V. B.

1373. Position of German Petroleum Economy. Anon. *Erdöl u. Kohle*, 1949, **2**, 256–257.—A statement issued by the German Petroleum Industry Association (Hamburg). For April 1949, refinery output was 129,000 tons and crude imports 147,000. Employees totalled 9046 and lost time 8·2%. Worker efficiency has increased considerably over the corresponding period of 1948. Difficulties encountered (*e.g.*, lack of brightstock) and the financial and market situation are outlined. V. B.

1374. Abadan and the Iranian Fields. X. Normand. *Bull. Assoc. franç. Tech. Pétrole*, 1949, (75), 25–41.—An account of the A.I.O.C. refinery at Abadan and its operation, with special reference to the production of the various components that are blended to give aviation gasoline. A brief description of the fields, including some historical notes, is given. V. B.

1375. How Bunker Prices Have Changed. *Motor Ship*, June 1949, **30** (82), 353.—Boiler and diesel oil prices at various ports are given and some comments made on the reductions since the beginning of the year. I. G. B.

1376. Chemical Antifoaming Agents. S. Ross. *Chem. Ind.*, May 1949, **64** (5), 757–759.—Up to recently traditional methods have been used for suppressing foam, *e.g.*, small amounts of castor oil in steam boilers, linseed oil in sugar-beet boilers, animal, vegetable, or mineral oils in paper-pulp suspensions. The study of such materials has brought knowledge of the molecular structure of the ingredients which have the requisite properties for preventing foaming, and the synthesis of such surface-active substances has provided a great variety of anti-foaming agents suitable for a wide range of application. Many are specifically designed for their intended use in industry, and are often so effective that in many applications only a trace, *e.g.*, 0·001% is required. The theory of foam inhibition is discussed, the important characteristic of a chemical to act as a defoaming agent is its spreading property with respect to the foaming liquid. This theory applies only to insoluble defoaming agents, but as most successful agents are insoluble in the foaming liquid it is not of great issue. The spreading coefficient, S, is defined as $S = \delta_F - \delta_{FD'} - \delta_D$ where δ_F is the surface tension of the foaming liquid, $\delta_{FD'}$ is the interfacial tension at the defoaming agent/foaming liquid interface, and δ_D is the surface tension of the defoaming agent. If S is positive, the agent will spread on the surface of the bubbles and ultimately cause them to break. If S is negative the agent will not spread and the foam will not be affected. The types of chemical anti-foaming agents are described and discussed under: (1) alcohols; (2) fatty acids and fatty esters; (3) amides of fatty acids; (4) ethers; (5) organic phosphates; (6) metallic soaps of fatty acids; (7) silicones. The compound, trade, brand and manufacturer's name, use, and particular characteristics are given. W. H. C.

1377. Mechanical Engineering and the Oil Industry. A. C. Hartley. *Proc. Instn mech. Engrs*, 1947, **157** (33), 325–328.—The contribution of mechanical engineering to the progress of the oil industry is described from the historical angle. Subjects covered include drilling, production, transportation, storage, refining, and wartime contributions. J. G. H.

BOOK REVIEWS.

" Analar " Standards for Laboratory Chemicals. London: British Drug Houses, Ltd, and Hopkins and Williams, Ltd, 1949. Pp. xviii + 302. 10*s.* 6*d.* net.

This is the fourth edition, revised and enlarged, of a now well-known publication. Apart from some 15 pages of preliminaries, the book contains 302 pages of data on 284 analytical reagents. This represents an increase of 65 reagents over those published in 1934 and includes a number of organic chemicals for use in inorganic analysis or as means for identification of organic substances by the formation of derivatives of known melting point.

Compounds of the following have been listed so that at least one compound of each of the more common elements would be included: beryllium, cæsium, cerium, lithium, selenium, strontium, tellurium, thallium, thorium, and titanium.

On comparison with the previous edition, it will be seen that additional tests for the purity of reagents are given, and many older ones have been replaced by modern methods and techniques; for example, electrolytic deposition, polarographic analysis, and the Karl Fischer procedure for the determination of water.

There are five pages of explanatory notes and five appendices, with a bibliography, an index, and a list of international atomic weights.

The format of the book is excellent, and the arrangement of the information given is easy to follow.

The inorganic analyst, in particular, would be well advised to obtain a copy for his bookshelf at the earliest opportunity. W. H. T.

Diesel Vehicles—Operation, Maintenance and Repair. Edited by F. J. Camm. London: George Newnes & Co., 1949. Pp. 104. 6*s*. 0*d*.

This book on diesel vehicles deals only with the engine, and covers exactly what the title indicates, namely operation, maintenance, and repair. It is particularly suitable for the young mechanic engaged on such work, and for this purpose the picture diagrams, of which there are a large number, are very suitable.

It is a good feature that 34 pages out of the 104 are devoted to the fuel-injectors, fuel-pumps, filters, and control, since these are special features of the diesel engine, and in these parts the majority of "faults" are located. In this part of the book will be found most useful advice which might easily be helpful to the more experienced diesel mechanic.

A useful cylinder-bore ridge remover is described on page 68 and illustrated on page 71.

The actual correct clearance in bearings, cylinder, etc., is stated, so it would be useful if the sizes of cylinder bore, stroke, r.p.m., and crankshaft diameter of the actual engines were given.

No mention is made of the thermodynamic principles on which the engine operates, and it is considered that a short chapter on this subject would be useful in giving the operator more interest in his work.

To encourage the systematic recording of wear figures, it would have been helpful to give examples of suitable charts for recording cylinder wear and crankshaft wear, with an indication of the wear at which these important items should be renewed.

The printing, which is on good paper, is easy to read, and the diagrams are good and clear, with useful descriptive wording alongside.

The chapter on auxiliaries is very useful, but the chapters on modern fuel oil engines and marine engines are too brief to be of much use, and the information is not all up to date. P. N. E.

Isomerism and Isomerization. Ernst David Bergmann. New York: Interscience Publishers. 1948. Pp. 133. $3.50.

This book gives the subject-matter of six lectures delivered at the Polytechnic Institute of Brooklyn during the winter of 1945–46 by Dr E. Bergmann, Director of the Daniell Sieff Research Institute, Rehovot, Palestine. The first chapter deals with the phenomenon of resonance from the point of view of the organic chemist. The following chapters are concerned with *cis* and *trans* isomerism and *cis* and *trans* interconversion; the isomerism of olefinic structures; the mechanism of substitution reactions and the Walden inversion; the isomerization of paraffins and the mechanism of intramolecular rearrangements.

In a book of 133 pages it is obviously impossible to deal with these subjects fully, and this limitation is realized by the author, who emphasizes in his preface that his intention is to promote further discussion. There are, however, some surprising omissions. In the chapter on racemization and the Walden inversion, there is no reference to the fundamental observations of Kenyon and his school upon which the greater part of our present views of the Walden inversion are based. Further, the phenomenon of restricted rotation and optical activity arising from it is discussed without mentioning the work of Mills or of Kenyon.

The chapter on the paraffins covers the theory of their isomerization and alkylation. A considerable proportion of the space is devoted to the work of Schmerling and of Bartlett. A much clearer picture of the nature of alkylation and the limitations

of our present knowledge of the course of the reaction would have been given if the author had included some account of the use of sulphuric acid in alkylation.

This is a book which cannot be recommended to any but those who are anxious or willing to learn some of Dr Bergmann's views on theoretical chemistry.

W. J. H.

Oil Shales and Shale Oils. H. S. Bell. New York: D. Van Nostrand Co. Inc., 1948. Pp. viii + 157. 22*s*.

As indicated in the preface, the purpose of this book is to present existing information on the methods and economics of mining and retorting oil shale, and refining the oil.

The information is gathered from those parts of the world where shale oil is being or has at one time been produced, and is applied to present-day American conditions in order to present a picture of how an industry might be established, to make use of the extensive oil-shale deposits known to exist on that continent.

The book opens with an historical review of shale-oil production, notably in France and Scotland. The industries in Australia, Manchuria, Estonia, and Sweden are also described, with brief reference to known shale deposits in other countries.

There follows a short description of shale-mining methods in use in shale-producing countries and a longer dissertation on possible mining developments based on modern American coal-mining practice.

A chapter is devoted to the preparation of oil shale for retorting, being largely a description of American plant for rock crushing, and omitting to identify the two-toothed roller type of crusher as that used in the Scottish industry for the last eighty years.

On the subject of retorting, plant which has been in use in Scotland and in Estonia for many years is described in fair detail. The most recent Scottish development, the Westwood retort, which has already been fully described in the technical Press, is not referred to. Retorts from France, Australia, England, and the U.S.A. are illustrated, but it is known that some of these never got far beyond the experimental stage. This chapter is inadequate in view of the great importance of retort design and of retorting methods in the production of shale oil.

The section on refining consists largely in a description of petroleum-refining equipment and methods.

Much of the information presented in the book has been taken from the report on the 1938 Glasgow Conference on Oil Shale and Cannel Coal. D. S.

BOOK RECEIVED.

Industrial Minerals of Colorado. George Argall, Jr. Golden, Colorado: Quarterly of the Colorado School of Mines, 1949, **44** (2). Pp. 477. $3.00.

The author of this book, a consulting engineer, was commissioned in 1948 by the Advisory Committee of the Board of Industrial Development Research of the State of Colorado to assemble and correlate available information on the industrial minerals and rocks of the state. Because of limited funds available, work was restricted to the compilation of data that could be obtained without field investigation.

A chapter is devoted to each of forty-two minerals (including bitumens) and rocks, data on properties, uses, occurrences, production, treatment, marketing, and prices being given, as well as, in some cases, lists of buyers and freight charges. A bibliography accompanies each chapter.

There are fifty-eight half-tone illustrations and two large maps.

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Oilfield Exploration and Exploitation.

Geology.

1378. Method for Determining the Effective Porosity of Petroleum Reservoir Rocks. M. A. Tsvetkova. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1949, 723–728.—Rock sample is freed from bituminous material by extraction and impregnated under vac with a coloured bakelite resin, which is then polymerized *in situ*. A plane section of the sample is cut and examined microscopically using polarized light, the area occupied by the dyed resin being measured. In the case of rocks having complex structures the effective porosity found decreases with increasing visc of the resin, and this latter should be isoviscous with the petroleum occurring in the sample. Photomicrographs of typical specimens thus treated are shown. V. B.

Geophysics and Geochemical Prospecting.

1379. Patent. Shell Development Co. B.P. 616,544 of 2.2.49. Apparatus for measurements employing neutron radiation. G. R. N.

Drilling.

1380. Analyzing Large Section Cores. W. W. Gibbs, R. S. Phillips, and A. G. A. Piercey. *Petrol. Engr*, May 1949, **21** (5), B-7.—In certain cases it is difficult to obtain small plugs representative of the full-sized core, for porosity and permeability measurements. A porosimeter for use with cores up to 3½-in dia and 4-in length has been developed. The apparatus consists of a core holder, Bourdon gauge, an air-receiver bottle, and closed-area manometer. The porosity is measured by filling the core-holder with air at any desired pressure and expanding the air into the evacuated receiving bottle. The change of manometer reading is used to compute the core volume.

Vertical permeability is measured by compressing a rubber tube on to the core by high-pressure air and measuring air flow longitudinally through the core. After vertical permeability has been measured the core is drilled by a ¼-in bit and the radial permeability measured by a similar means. The core ends are sealed against rubber sheeting. The gas flowmeter systems are the same as used on conventional core plugs. A calculation for radial permeability is described. References are appended.
C. G. W.

1381. Casing Design Simplified in Combination Strings. E. E. Curran. *Petrol. Engr*, May 1949, **21** (5), B-50.—(See Abstract No. 8.) C. G. W.

1382. Improvements in Cementing Practices. G. E. Cannon. *Petrol. Engr*, May 1949, **21** (5), B-42.—Improvements in cementing practices are due in part to better evaluation of the properties of oil-well cements, of the condition of the hole, and studies of the filtration properties of muds and cements. Roto-wall cleaners are very effective in securing efficient cementing, and reducing the number of squeeze jobs required.

Bentonite cement mixed with a sealing agent has proved very effective for regaining lost circulation in certain cases where sealing agents were ineffective.

The desirability of standardization of cementing regulations is emphasized. A

waiting time of not more than 24 hr is recommended, since tests have shown that most cements develop sufficient strength in this time to justify resuming operations.
C. G. W.

1383. Core Testing for Offshore Foundations. Anon. *Petrol. Engr*, May 1949, **21** (5), B-72.—The time and expense involved in pile driving foundations for offshore structures necessitate that the minimum depth be driven consistent with safety. A temporary core-drilling rig is set up, and cores of the bed rock and samples of soil are taken while construction is begun on the main structure. Cores are tested in compression, and from data obtained the minimum penetration depth is computed. The core hole is drilled to about 50 ft below the deepest penetration of any pile to estimate any settling likely to occur. C. G. W.

1384. Drilling Completion and Production Practices in Alberta. J. E. Baugh. *Oil Gas J.*, 23.6.49, **48** (7), 165.—Drilling problems encountered include high-pressure surface gas pockets and loss of circulation in the D2 and D3 zones. The casing programme is designed to eliminate the lost circulation and blowout hazards. Leduc D2 and D3 are acidized with large and small wash shots respectively. At Redwater acidization has proved very effective in the D3 zone.

Production practices are briefly mentioned. C. G. W.

1385. Drilling Mud Programmes for W. Texas Wells. C. W. Scamman. *Petrol. Engr*, June 1949, **21** (6), B-13.—As mud engineering becomes a more specialized job, drilling mud programmes correlated with drilling and casing programmes are coming into greater use. Three possible programmes for drilling wells in West Texas are given. In certain formations in West Texas more hole can be made by drilling with water than with low-water-loss mud.

The disadvantages of high-water-loss fluid, even in such formations, lie in the difficulty of maintaining the hole in good condition and of recovering good sized cuttings for inspection.

Nomographs for determining the total quantity of mud required for a job are presented. C. G. W.

1386. Use of Oil-base Mud to Free Stuck Pipe. G. Miller. *Petrol. Engr*, June 1949, **21** (6), B-54.—In some cases of stuck drill pipe oil-base mud is effective in freeing the pipe. Twelve attempts have been made with one particular oil-base fluid, and ten of these were successful. In some cases pills of diesel oil are spotted at the stuck sections before circulating. The action of the oil-base fluid is to soften and flocculate clay and cakes. Details of operation in a number of applications of the method are described. C. G. W.

1387. Pneumatic Controls for Power Rig Equipment. E. L. Holbrook. *Petrol. Engr*, May 1949, **21** (5), B-63.—It is necessary for any complex control system such as encountered on power rigs, to be flexible, rugged, and as simple as possible. Compressed-air controls, with smooth operation easily adapted to complex systems, which can be installed and maintained by a mechanic, have great advantages for the purpose.
C. G. W.

1388. Spiral Bevel Gears Used in Portable Rig. N. A. D'Arcy, Jr. *Petrol. Engr*, June 1949, **21** (6), B-34.—This portable rig uses three 150-h.p. engines operated through a spiral bevel gear compounding case. The engines are equipped with torque converters connected to the gear case through jaw-type clutches. The torque converters enable all clutches to be engaged before opening the throttle, thus reducing shockloads on the compounding case and hoisting system. The derrick is a 90-ft/300,000-lb-capacity guyless derrick with a 525-h.p.-capacity drawworks. The unit can drill economically to 6500 ft or deeper, and is sufficiently portable for use in 2500–3500 ft programmes.
C. G. W.

1389. Tool Reflects Stuck Pipe Conditions. P. W. Martin. *Petrol. Engr*, May 1949, **21** (5), B-54.—The Magna-tector, an electronic device for determining where a pipe is stuck, has been described previously. This article describes the operating principles

of the tool, possible conditions causing sticking of the pipe, and the interpretation of readings in terms of subsurface conditions. C. G. W.

Production.

1390. Counterbalance Requirements. K. N. Mills. *Petrol. Engr*, June 1949, **21** (6), B-50.—The counterbalance and the peak well load determine the magnitude of the peak torque load, and hence the size of pumping unit required.

The purpose of counterbalance is to equalize the work done on upstroke and downstroke and can be determined from a dynamometer card.

From theoretical considerations an equation for counterbalance is derived

$$CB = \frac{W_0 - C}{2} + Wr$$

CB = counterbalance required;
W_0 = weight of oil on nett plunger area;
C = cross-sectional area of sucker rod × fluid pressure at bottom of the hole due to fluid column in tubing.
Wr = weight of the rods.

A graph of percentage of peak well load that can be counterbalanced *vs* plunger diameter is given. C. G. W.

1391. Drilling and Production (in Poland) in Feb. 1948. H. Górka. *Statystyka Naftowa Polski*, Feb. 1948, **4**, 139–143. [Supplement to *Nafta*, Apr. 1948, **4**.]—Figures are given for quantities of crude pumped, gas produced, unrefined gasoline obtained, and drilling operations in progress during February 1948. A graph is plotted showing crude and natural-gas production together with origin for 1947/8. Data for 1948 include January and February only. Some outstanding figures are also given.

The monthly figures are: crude, 10,579,663 kg; natural gas, 15,257,000 m³; gasoline fraction, 727,465 kg; drilling, 5190 m in eighty wells.

Four pages of comprehensive tables are given. M. S.

1392. Dynamic Calculation of Sucker Rods for Deep Oil Pumps Taking into Account Friction Forces against the Pump Pipe. I. A. Charnuii, A. I. Freidenzon, and Ts. T. Arustamova. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1949, 855–875.—A method is developed for measuring the displacement and stress at any point on the pump rod and also for the experimental determination of the coeff of friction. The treatment is mathematical, and theoretical findings are compared with experimental results depicted on indicator diagrams taken at the point of attachment of the pump rod to the beam. V. B.

1393. Hydrafrac Process for Increasing Productivity of Wells. J. B. Clark. *Petrol. Engr Ref. Annual*, 1949, **21** (7), B-3.—(See Abstract No. 24.) C. G. W.

1394. Progress in Production Equipment. Anon. *World Petrol.*, May 1949, **20** (5), 62.—Development in equipment and procedure in the past year are described. Examples are: the hydrafrac process, acoustic impedance logging, electrical system for controlling bit weight, remote drilling controls, and rotary percussion drilling, etc. C. G. W.

1395. Reservoir Studies Aided by Data and Mathematics. W. Hurst. *Petrol. Engr*, June 1949, **21** (6), B-66.—The importance of adequate data, *e.g.*, mud logs, drill-cutting analyses, and core electrical and radioactivity logs, etc., is emphasized. It is concluded that with the mathematical methods available and a sufficiency of data the majority of reservoir problems can be overcome. C. G. W.

1396. Patent. N. F. Brown. B.P. 616,887 of 9.2.49. Raising of natural oil and other liquids by gaseous pressure. G. R. N.

1397. Hydrafrac Process. J. B. Clark. *Oil Gas J.*, 26.5.49, **48** (3), 75.—The process consists in injecting into the formation a viscous liquid such as gelled gasoline under sufficient pressure to break down the formation. The viscosity of the gel is then reduced by means of a gel breaker and removed from the formation. Important factors to be considered are: (1) formation permeability; (2) formation thickness; (3) adaptability of zone to isolation; (4) prior workovers; (5) isolation of formation behind casing; (6) pump capacity.

An analysis of wells where this treatment has been carried out indicate that where all the above factors were satisfactory a successful treatment was accomplished. Results in several fields are briefly described.

The process appears to have a potential application to secondary recovery operations.

C. G. W.

1398. Oil Recovery Predictions. G. R. Elliot and W. L. Morris. *Oil Gas J.*, 16.6.49, **48** (6), 84.—A nomograph, constructed from previous modified theoretical studies, is prescribed for use in predicting oil recoveries from solution-gas-drive reservoirs. The nomograph relates primary oil recovery to oil viscosity, oil shrinkage, connate water saturation, and porosity. A second nomograph predicts combined total of primary recovery and oil available for secondary recovery.

References are appended.

C. G. W.

Oilfield Development.

1399. Exploratory Drilling in 1948. F. H. Lahee. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 783–804.—The June 1949 issue of the *Bulletin of the American Association of Petroleum Geologists* is devoted to a review of exploration and developments in 1948. This is the introductory paper by the chairman of the A.A.P.G. Committee on Statistics of Exploratory Drilling.

During 1948, 8013 exploratory wells were drilled in the United States. Of these, 4296 were new-field wildcats, 1951 were new-pool tests (including new-pool wildcats, deeper-pool tests, and shallower-pool tests), and 1766 were outposts. Among the new-field wildcats, 501 were successful; among the new-pool tests, 427 were successful; and among the outposts, 490 were successful.

The total exploratory footage drilled in the United States in 1948 was 32,741,097 ft, or 4086 ft per hole. These figures compare with 26,393,348 ft drilled in 6775 exploratory holes, with an average depth of 3896 ft, in 1947.

E. N. T.

1400. Highlights on 1948 Development in Foreign Petroleum Fields. L. G. Weeks. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 1029–1124.—This paper gives a very detailed and comprehensive survey of drilling and production activities in most countries of the world during 1948. In this year the percentage proportion of oil produced for the major oil areas was as follows: U.S.A. 59%; Venezuela 14·3%; Middle East 12·6%; Russia 6·4%. In 1947 the respective figures were 61·4%, 14·4%, and 6·5%. The salient difference therefore lies in the relative increase of Middle East production. A significant trend noted in recent years is the fact that although measured in exploration activity, or drilling rigs operating, the total oil-seeking effort of the rest of the world is much less than half that of the U.S.A., the proportion of the oil actually found in 1948 and the increase in oil produced over 1947 by the other countries were each more than double the U.S. figures.

An interesting series of maps of the main sedimentary areas is presented.

E. N. T.

1401. Developments in Arkansas and North Louisiana in 1948. J. R. Williams. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 990–1001.—The total number of wells drilled during 1948 in Arkansas and North Louisiana totalled 1811, compared with 1343 wells drilled in 1947.

There were 220 wildcats drilled in 1948, and the decrease in wildcatting in 1948 was consequently 7¼%. Much of the increase in total wells drilled in 1948 was due to heavy drilling in old shallow fields such as the Caddo field in Caddo Parish, Louisiana, which increased from 306 producing wells drilled in 1947 to 718 wells in 1948.

In Arkansas four new oilfields were discovered. In North Louisiana three new oilfields, one new distillate field, and four new gas fields were discovered.

E. N. T.

1402. Developments in Arizona, Western New Mexico and Northern New Mexico in 1948. P. H. Umbach. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 931–934.—Eleven fields in this area produced a total of 369,850 brl of oil and 8631 M.c.f. of gas in 1948. Twenty-eight wildcat wells with a total footage of 95,099 ft, were drilled in New Mexico, resulting in five commercial discoveries. No new oil wells were successful in Arizona. E. N. T.

1403. Developments in Atlantic Coastal States Between New Jersey and North Carolina in 1948. H. G. Richards. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 1011.—The only oil test drilled in this area in 1948 was one in North Carolina which was unsuccessful. Production continued in the Rose Hill field of southwestern Virginia, and one important gas discovery was made in Buchanan County. E. N. T.

1404. Developments in California in 1948. G. B. Moody. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 805–826.—During 1948 in California, the total exploratory footage in 488 exploratory wells completed as producers or abandoned as dry holes was 2,005,366 ft. Exploratory activity during the year was greater by 38·6% as to number of wells and 27·6% as to footage than in 1947. Exploratory wells were 16·6 and 15·6% successful as to number and footage, and discovered a total of forty-nine new fields and new pools, of which nine were gas and forty were oil. New fields, new pools, and extensions added 151 million brl to oil reserves, 8 million brl to natural-gas liquids reserves, and 240,000,000 M.c.f. to gas reserves. Production during the year was about 340,069,000 brl of crude oil, 189,933,000 M.c.f. of gas from dry gas fields, 421,200,000 M.c.f. of wet gas from oilfields, and 26,480,000 brl of natural-gas liquids (including condensate). E. N. T.

1405. Developments in Illinois and Indiana in 1948. A. H. Bell, R. E. Esarey, and B. E. Brooks. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 866–876.—During 1948, 3571 wells were drilled for oil and gas in Illinois and Indiana as compared with 2727 in 1947. Total oil production decreased slightly from 72,901,000 brl in 1947 to 72,480,000 brl in 1948. Fifty-one new pools, sixty-three extensions, and forty-eight new producing zones were discovered, mostly in Mississippian formations, but the Devonian limestone also produced oil in five new pools. E. N. T.

1406. Development in Kentucky in 1948. E. B. Wood. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 853–862.—The total number of wells drilled in Kentucky in 1948 was 15·1% below the 1947 total, and oil production declined to approximately 8,926,000 brl. However, the total open-flow gas development in 1948 was 287,814 M.c.f. even with a 38·3% decrease in the number of gas wells drilled.

By far the greatest number of the 42, 1948 new discoveries were made in the western part of the state.

There has also been a great deal of deeper drilling activity, most of which took place in eastern Kentucky. E. N. T.

1407. Developments in Louisiana Gulf Coast in 1948. W. McBee, Jr., and P. J. Orchard. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 979–989.—During 1948, 803 tests were drilled in the South Louisiana district. The 129 rank wildcat tests resulted in the discovery of twenty-eight new fields. Of the 674 field development tests, 463 were successful and 211 were failures. The twenty-eight new field discoveries include thirteen oilfields, eleven condensate fields, and four gas fields.

Of great significance is the fact that seven of the new fields were discovered in the open waters of the Gulf of Mexico, three of which are oilfields, two condensate fields, and two gas fields.

The most significant exploratory activity in 1948 was made in the offshore Miocene trend. There has been a noticeable increase in geophysical and leasing activities in the area northeast of the Mississippi River. E. N. T.

1408. Developments in Michigan in 1948. M. Osgood, Jr. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 877–822.—Of the 310 wildcat wells completed during 1948 in Michigan twenty-two were successful, resulting in the discovery of ten new oilfields, four new gas fields, and in the extension of eight oilfields. The Pentwater field in Oceana County appears to be the most important discovery of the year. At the year's end fifty-two wells in this field were producing *ca* 3500 b.d.

Total footage drilled during the year was 2,120,000 ft, a 6½% increase over 1947.

Oil production for 1948 was 16,871,046 brl, an increase of 4% over 1947, and marked the end of a five-year decline. Gas production of 21,369,587,000 cu. ft. was down to 10%, the first annual decrease in the history of Michigan gas production.

E. N. T.

1409. Developments in North Mid-Continent in 1948. J. R. Berg. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 883–891.—Some sixty-nine new oilfields were discovered in Kansas in 1948, consisting of fifty-nine new oil discoveries, five revivals of previously existent oil pools, and five new gas discoveries. In addition to the above discoveries, there were approximately thirty near-wildcat discoveries which extended already-named and existent pools or fields.

There were no important developments during the year in the states of Iowa, Missouri, and Nebraska.

Kansas produced approximately 110,298,154 brl of crude oil and casinghead gasoline during the year 1948, in comparison with the 1947 total of 106,060,019 brl. Gas production for the year amounted to approximately 240,000 million cu. ft., compared with the 1947 total of 183,527,266,000 cu. ft. E. N. T.

1410. Developments in New York in 1948. E. R. McAuslan. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 837–840.—In the New York area twenty-two wells were completed or drilling in the Oriskany gas-sand area at the end of 1948 as compared with twenty-seven in 1947. Fourteen of these wells were failures, and six were in storage fields. There were no new discoveries. Total Oriskany gas produced was 2,185,102 M.c.f. In the oilfields, 1742 wells were drilled, and the daily average oil runs to pipelines was 12,329 brl. Eighteen shallow Devonian wildcats were drilled, three of which showed slight amounts of oil. E. N. T.

1411. Developments in Ohio in 1948. J. R. Lockett. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 848–849.—In all, 1522 tests were drilled in Ohio during 1948, exclusive of holes drilled for gas storage. A total of 3,864,592 ft of hole was completed. No important new fields were discovered, and extensions conformed to normal expectations.

E. N. T.

1412. Developments in Oklahoma in 1948. D. C. Wellman. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 892–904.—The outstanding development in Oklahoma during 1948 was the continued success of exploratory drilling in the Elk City area, on the southwest flank of the Anadarko basin, which emphasized the geologic significance of "granite wash" production in Oklahoma.

Production of oil increased to 155,578,453 brl, representing an increase of 9·9% over the 1947 production. Total reserves of crude oil increased by 31%. Production of marketed natural gas increased to 276,542,084,000 cu. ft., and casinghead gas to 178,751,567,000 cu. ft., or 12% over the gas marketed in 1947. E. N. T.

1413. Developments in Pennsylvania in 1948. C. R. Fettke. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 841–847.—During 1948, exploratory drilling in western Pennsylvania (Upper Devonian or higher productive strata) led to the discovery of five new gas pools and one oil pool, none of which was significant in size. The total number of shallow wells drilled was 10% less than in 1947. In the Pennsylvania part of the Bradford oilfield 2070 new wells were completed, as compared with 1840 in 1947. About half of these were water-intake wells. The Bradford field accounted for 80% of the total oil production in Pennsylvania during 1948. The average daily oil production in the state in 1948 was 35,206 brl.

Thirty new wells were completed to the deeper formations (Onondaga or deeper) as compared with twenty-eight in 1947. Of these only nine were gas wells. The greatest

activity centred in the East Fork Oriskany sand gas pool of north-central Pennsylvania where eight wells were completed, whose initial open-flow capacities ranged from 2 to 10 million cu. ft. of gas per day. E. N. T.

1414. Developments in Rocky Mountain Region in 1948. C. L. Dorn. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 827–836.—Seventy-three of the 277 exploratory wells drilled in the Rocky Mountain region during 1948 were successful. Permian and Pennsylvanian strata provided the most new discoveries.

New pools discovered in the Deadwood formation of Cambrian age at Wertz and Lost Soldier, and in the Mesa Verde formation in Wyoming were of great significance, as neither of these formations had hitherto been productive in the Rocky Mountain states.

Geophysical work increased during 1948, with the centre of activity in Wyoming. Production of crude oil showed gains corresponding with the increased rate of exploratory drilling. E. N. T.

1415. Developments in Southeastern States in 1948. R. M. Harris and W. M. Payne. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 1002–1010.—Wildcatting in the states of Alabama, Florida, Georgia, and Mississippi continued at approximately the same rate as in 1947, while development in established producing areas showed a decline. Geophysical crew weeks worked decreased during the year to 2356 from the 1947 figure of 2588.

One producer was added to the Gilbertown field in Alabama, whose production was 480,316 brl during 1948.

Florida had a total of twenty-four wildcats drilled and abandoned in 1948. Production from the Sunniland field was 290,000 brl in 1948.

Georgia had three wildcats drilled and abandoned in 1948.

Mississippi had a total of 109 wildcats drilled during 1948 which resulted in the discovery of five new fields and four salt domes. All Mississippi fields produced a total of 45,662,115 brl of oil and condensate during the year. E. N. T.

1416. Developments in Tennessee in 1948. H. C. Milhous. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 863–865.—During 1948, sixty-seven wells were completed in Tennessee, of which thirty were commercial producers. The total oil produced during the year was 19,485 brl, about twice the 1947 production. E. N. T.

1417. Developments in East Texas in 1948. G. C. Clark. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 956–965.—During 1948, 873 wells were drilled in the East Texas district; of this number 147 were wildcats and field-extension wells. Twenty-one new-field and new-pool discoveries were drilled, twelve of the twenty-one were considered new-field wildcats; three were deeper-pool discoveries, six were shallower-pool discoveries, and the remainder of the 147 were dry holes.

Accumulated production for the district has reached a total of 3,470,346,500 brl, of which total, 2,588,533,142 brl have been produced from the East Texas field. The 1948 production from the entire district was slightly lower than that of 1947, being 174,580,000 brl, as compared with 174,846,263 brl for 1947. E. N. T.

1418. Developments in North and West-Central Texas in 1948. W. L. Ammon, L. W. Dorbandt, and J. H. Stovall. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 935–944.—During 1948, production in the North and West-central Texas district increased to 71,469,000 brl. Drilling showed a gain, with a total of 4009 tests drilled in 1948, of which 2150 were productive. Of the total wells drilled, 1113 were exploratory, which resulted in 202 new producing discoveries, including wildcat pools, deeper producers, and extensions. E. N. T.

1419. Developments in Texas Penhandle in 1948. R. A. Fickel. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 905–907.—Production in the Texas Penhandle area increased by 2·1 million brl of oil and 48,000 million cu. ft. of gas over 1947. The total production in the year was 31·9 million brl of oil and 882,700 million cu. ft. of gas. E. N. T.

1420. Developments in South Texas in 1948. B. Scrafford. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 945–955.—Development work in the South Texas area during 1948 showed a 23% increase over the previous year. In all, 2987 tests, 2518 wells in proved areas, and 829 wildcat wells were drilled, and resulted in 1915 successful completions.

Wells drilled in productive areas found 155 new producing beds in eighty-four fields, the Frio-Vicksburg trend accounting for 108 of the total. At the close of 1948, 16,738 oil wells had produced 169,739,954 brl of oil, 10% more than had been produced from the area during the previous year. E. N. T.

1421. Developments in Upper Gulf Coast of Texas in 1948. F. E. Mettner. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 966–978.—There were 1114 wells drilled in the Upper Gulf Coast district of Texas in 1948, which is a 27% increase over 1947. Of these, 212 were wildcat tests which resulted in the discovery of twenty-two new fields, comprising nine oilfields, ten gas-condensate fields, and three gas fields.

Considerable extra reserves were added by development in old fields. Most of these additions to reserves were the result of the discovery of new fault segments and new sands on old salt domes. First production was established on an interior salt dome in Madison County.

Total oil and condensate production in this area of Texas in 1948 amounted to 197,055,000 brl, which is an increase of 6 million brl over 1947. E. N. T.

1422. Developments in West Texas and South-East New Mexico in 1948. C. F. Henderson and C. R. Barr. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 908–930.—During 1948 there were 3839 tests drilled in West Texas and Southeast New Mexico. Of these 469 were exploratory tests, of which 131 were producers. Fifty-six new fields and thirty-six new pools were discovered.

An important aspect of the 1948 development is the apparent beginning of a shift in interest away from the Central Basin platform. E. N. T.

1423. Developments in West Virginia in 1948. R. C. Tucker. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 850–852.—During 1948, 934 wells were drilled in West Virginia. Wells completed were: gas, 590; oil, 131; oil and gas, twenty-six; storage, etc., nine; dry, 178. Wells ranged in depth from 283 to 8942 ft, compared with 385 to 8120 ft in 1947. Total footage drilled was 2,520,757 ft, compared with 2,570,198 ft in 1947. The total daily initial volume of gas was 491,441 M.c.f., compared with 506,672 M.c.f. in 1947. The total initial daily oil was 2479 brl., compared with 1567 brl in 1947. Preliminary estimates of production for 1948 are: gas, 221,130,000 M.c.f.; oil, 2,695,000 brl. E. N. T.

1424. Developments in Canada in 1948. J. G. Gray and W. A. Roliff. *Bull. Amer. Assoc. Petrol. Geol.*, 1949, **33**, 1012–1028.—The year under review was extremely active in Canada, and this paper gives an exhaustive review of drilling and exploration activities. The most important discovery was the Devonian reef pool at Redwater, 45 miles northwest of the prolific Leduc field. In all, 399 new wells were drilled in Alberta, resulting in 202 oil wells, nineteen gas wells, and one condensate well. The total daily average oil production in December 1948 was 37,785 brl.

In Saskatchewan, the Lower Cretaceous Lloydminster–Lone Rock pool was developed and total production for the year was 851,409 brl.

In British Columbia, four successful gas wells were drilled in the Peace River area. In Manitoba geological and geophysical surveys were carried out and a gas well begun. In Eastern Canada 285 development wells and sixty-five exploratory wells were drilled in Ontario, and also a few in other eastern areas, but new discoveries were small. E. N. T.

1425. Results of Pressure Restoration in Oil Wells in Poland. A. Mikucki. *Nafta*, Apr. 1948, **4**, 132–137.—All pressure-restoring equipment was lost during the 1939–1945 war. During the following twenty-six months great progress was registered and production increased by approx 4¼ million kg in 1946 and 8 million kg in 1947, which

compared with 1945 production of the area under consideration represents 37·8% and 54·8% respectively.

Comprehensive tables are included. M. S.

Transport and Storage.

1426. Corrosion. Rectifiers and Galvanic Anodes for Cathodic Protection. A. L. Stegner. *Pipe Line News*, June 1949, **21** (6), 18.—In installing a protective system a number of points must be considered. (1) Type and condition of structure; (2) current requirements; (3) power availability; (4) right of way; (5) accessibility; (6) availability of materials; (7) proximity to foreign systems; (8) soil resistivity.

Periodic checks are necessary in both cases to determine the condition of the protective system.

Maintenance and servicing is a greater expense in the case of rectifier installation than with galvanic anodes. Anodes must be replaced at the expiration of their designed life. Checks are necessary to determine the condition of the anodes. Examples of both rectifier, galvanic anodes, and combination systems are described.

C. G. W.

1427. Flow Efficiency of a 30-in O.D. Natural-Gas Transmission Line. N. C. Mosteller. *Oil Gas J.*, 7.7.49, **48** (9), 81.—Based on operating data from the California section of the Texas–Pacific line, and using the Nikuradse smooth-pipe formula, the flow efficiency of the line has been determined.

Factors determined included actual line capacity compared with designed capacity, change of efficiency with age of line, and variation of efficiency with flow rate (or Reynolds Number) through the line.

Tables show that the line has its design capacity, but data collected was not sufficient to determine whether there was a change in efficiency with age or whether a change occurs with flow rate over range of conditions investigated.

Factors considered in the computations included evaluation of Reynolds Number, corrections involving gas deliveries which may be made at intermediate points, and for differences in elevation along the line.

Tables include one giving sample computation for elevation correction and determination of effective $Y(P^2 - Pa^2)^2$, and figures include one showing relationship between fraction factor and Reynolds Number. G. A. C.

1428. Pipe Line Communications. F. W. Littell. *Pipe Line News*, May 1949, **21** (5), 14.—In order to co-ordinate various functions of any complex system, an efficient communication system is essential. Until recently the majority of pipeline systems used telegraphy and telephony. Private telephonic and telegraphic systems were found to have advantages over systems leased from public services.

In recent years frequency-modulated radio communication on very high frequencies has become an important means of communication.

On such a system using directional antennæ it is possible to obtain a number of voice-frequency channels which can be used for speech circuits and also for teleprinter and dialling circuits. Since such a system is limited to line-of-sight broadcasting, intermediate repeater stations are necessary over a long system.

For end-to-end communications and communications with aircraft, tankers, etc., a high-frequency radio system can be installed at terminals and intermediate stations.

C. G. W.

1429. Pressure Vessels. A. C. Vivian. *I.P. Review*, June 1949, **3** (30), 161.—When thin steel pipes are burst by internal pressure the circumference has increased by 7½%. The diametrical strain can be measured with a steel tape. It can be assumed that any circumferential ring of steel in the wall of the pipe behaves as a steel bar in direct tension. At temperatures up to 650° F, internal pressures of more than 200 p.s.i. and at temperatures of 1000° F, internal pressures of more than 500 p.s.i. necessitate the use of thick pipes (thickness greater than 10% of the diameter), but few pipes and vessels in refineries and oilfields come within these limits. R. H.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1430. Ashland Modernize Wartime T.C.C. Units. A. W. Hoge and W. Tiernan. *Petrol. Engr*, Apr. 1949, **21** (4), C-7.—Modernization consisted of adding new zones to the regenerator unit so increasing the carbon burnt by 40%, redesigning some of the internal reactor fittings (disengaging mechanism), and converting the reactor from countercurrent to concurrent flow. These changes resulted in the gasoline yield increasing from 42 to 57% with increase in quality and also resulted in an increase in the yield of furnace oil to 25·5% of the change. G. K. A.

1431. Cost-imating Blowers and Compressors. W. L. Nelson. *Oil Gas J.*, 30.6.49, **48** (3), 91.—No. 37 in the series gives tables showing factors to convert costs on a cubic foot per minute basis to h.p-basis, and h.p. to compress 1 cu. ft. air per minute from atmospheric to pressure shown; costs of compressors and blowers and miscellaneous compressor accessories, diesel engines, etc., all costs based on year 1946. G. A. C.

1432. Cost-imating Compressors. W. L. Nelson. *Oil Gas J.*, 23.6.49, **48** (7), 223.—No. 36 in the series gives approximate cost indices for years 1939–49 for compressors, engines, and gas-pumps.

Tables show approximate costs per h.p. of large compressor installations, and of compressor and accessories per cubic foot of free air per minute discharging at 100 p.s.i. G. A. C.

1433. Cost-imating Refrigeration Plants. W. L. Nelson. *Oil Gas J.*, 7.7.49, **48** (8), 95.—No. 38 in the series gives a table showing cost indices for refrigeration equipment and labour for years 1924–49.

Further tables show approximate costs (1946) of refrigeration systems per ton refrigeration with and without auxiliaries for evaporator temperatures ranging from 50° F to minus 90° F. G. A. C.

1434. Electronic Leak Detector. R. Snedden. *Petrol. Engr*, Apr. 1949, **21** (4), C-11.—This instrument is suitable for leak detection in the laboratory and on plant, and is the most sensitive method known. The apparatus consists of a vacuum pump to suck the atmosphere under test through a nozzle into the detector. Helium is the testing fluid, and the detector, a modified mass-spectrometer type of instrument, signals visibly and audibly the presence of this helium. Leaks of the magnitude of 10^{-9} c.c per sec are detected. G. K. A.

1435. New Gasoline Plant Uses Direct Heaters. J. C. Albright. *Petrol. Engr*, Feb. 1949, **21** (2), C-7.—Thirty million cu. ft. of gas per day in two streams, one sweet, one sour, are handled. Sour gas is purified by diethanolamine extraction before mixing with the sweet gas. Water is very limited at the site, so the plant uses no steam but direct heating of the reboilers and hot oil for other heating. Aerial coolers are used for the products with a small water-cooler to obtain complete condensation. All piping and fittings are above ground, and control is from a central control point. G. K. A.

1436. High LPG Recovery at New California Plant. Pt. 1. M. E. Garrison. *Petrol. Engr*, Mar. 1949, **21** (3), C-24.—The intention of this article, which is in three parts, is to describe in detail the development and design of a natural gasoline plant and its auxiliaries. The first part deals with the gas-collection system and the gasoline plant. G. K. A.

1437. High LPG Recovery at New California Plant. Pt. 2. M. E. Garrison. *Petrol. Engr*, Apr. 1949, **21** (4), C-13.—In this part details are given, including flow sheets and detailed material process flow calculations, of the following units, propane refrigeration, gas flow, drip condensate, oil-conditioning unit, and the compressor station. G. K. A.

1438. Mechanical Removal of Entrained Materials from Natural Gas. F. H. Dotterweich. *Petrol. Engr*, May 1949, **21** (5), C-32.—For the removal of dust from natural gas the Blaw-Knox cleaner has been used since the early thirties. This uses oil as a scrubbing medium. One recent separator is the Parks Liquid Knockout. This removes hydrocarbon and water at high pressure, while it forms a compact unit which can be buried. This unit, for which a diagram is given, consists of a mist extractor and liquid separator and an automatic liquid-dumping system. The Aerotec Tube Method used the Aerotec Tube developed during the War. Each tube consists of a centrifugal separator, and the tubes are connected in parallel to give the required throughput. The pressure drop is low, and the efficiency of dust and mist removal is very high.

G. K. A.

1439. Trends and Developments in Petroleum Processing Equipment. D. L. Gilbertson. *World Petrol.*, May 1949, **20** (5), 56.—Demand for higher-octane fuels necessitates an increase in catalytic capacity. This has led to the streamlining and modifying of cracking units to make them available to the small refiner.

Trends in burners, pumps, and other equipment are briefly described.

C. G. W.

1440. One Way to Treat Spent Caustic. J. C. Albright. *Petrol. Engr*, Apr. 1949, **21** (4), C-32.—The process is a batch process to treat spent caustic used for extracting phenols and hydrogen sulphide from cracked gasoline, so that the resulting liquor can be dumped into the sewers without harm. The spent caustic is circulated from a reboiler through a small perforated plate column. Flue gas bubbles violently into the reboiler and further contacts the solution in the tower; the gas from the top of the tower (containing sulphur compounds) is fed to the furnaces. The circulation is continued until all the sodium sulphite is converted to carbonate, when the batch is transferred to a settling tank, the phenols skimmed off, and the sodium carbonate either dumped or recovered.

G. K. A.

1441. Patents. H. R. Ricardo and I. E. Graham. B.P. 613,283 of 8.12.48. Heat exchangers.

Foster Wheeler Ltd. B.P. 613,730 of 15.12.48. Heat exchangers.

Anglo-Saxon Petroleum Co., R. Rigby, and J. C. S. White. B.P. 614,453 of 31.12.48. Heat exchangers.

Texaco Development Corpn. B.P. 615,719 of 26.1.49. Reciprocating pumps for handling liquids.

G. R. N.

Distillation.

1442. Carter's Billings Plant. Anon. *Oil Gas J.*, 23.6.49, **48** (7), 112.—A 20,000-brl refinery is being constructed for Carter Oil Co. in the Rocky Mountain area at Billings, Mont. It will produce gasoline, kerosine, heating oils, diesel fuels, asphalt, and fuel oil.

Refining processes consist of atmosphere and vacuum distillation, together with catalytic desulphurization and gasoline refractionating, plus facilities for treating desulphurized distillates.

Special alloy materials have been used to provide adequate corrosion resistance, since the crudes have a high sulphur content.

Flow diagrams of the crude distillation and fluid catalytic-cracking units are provided.

G. A. C.

1443. Rationalization of Compressor Plant Equipment. Z. Ziolkowski. *Nafta*, Apr. 1948, **4**, 146–148; May 1948, **4**, 177–178, 184–186; June 1948, **4**, 218, 224–227.—The author sets out to analyze mathematically the process of compression of light hydrocarbons, paying special attention to the effects of permanent gases and the part played by "inter-stage pressure." This analysis may be used as a starting point for rationalization of compressor equipment, and thus is useful for effecting great saving in investments and pumping losses.

Part 1 consists of a description of compression apparatus for one-stage and two-stage compression as well as for compression aided by carbon or oil absorption. A table

gives a mol per cent analysis of liquid and gaseous phases. Adsorption is very costly below certain gas content, so compression must be introduced prior to that.

Part 2 gives the calculations involved and the practical considerations which follow. The number of unknowns is greater than the number of equations, so two mixtures are treated and the results extensively tabulated and graphed against composition of liquid phase, power consumption, and costs. High pressures offer a distinct advantage, but the solubility of permanent gases in liquid phase presents a difficulty. Three-stage compression is advised, and a suitable choice of intermediate pressure may solve such problems satisfactorily.

References are given to two Russian authors and one German. M. S.

Absorption and Adsorption.

1444. Sid Richardson's New Gasoline Plant. D. H. Stormont. *Oil Gas J.*, 16.6.49, **98** (6), 82.—Completion of the Sid Richardson Gasoline Co's natural gasoline plant in the Keystone field of West Texas has entirely eliminated flaring of field gas.

The plant is described, and is designed for a butane recovery of 98% and a propane recovery of 75%.

Lean oil is removed at two levels in the two main absorbers, passed through propane chillers and returned to absorbers. Reflux of the de-ethanizer and final condensation of the still overhead vapours is achieved by propane refrigeration.

Total capacity of plant can reach 115,000 million cu. ft.

A flow diagram is given. G. A. C.

1445. Elk Basin Plant of Standard Oil Gas Co. L. R. Lyon, R. A. Feagan, and H. B. Manley. *Oil Gas J.*, 30.6.49, **48** (8), 70.—The oilfield system of the Elk Basin, Wyoming, yields 12 million cu. ft. per day of casing-head gas from which is extracted H_2S,CO_2, gasoline, butane, and most of the propane by the plant erected by Stanolind Gas Co.

A fuel gas suitable for plant boilers, a saleable residue gas at 500 p.s.i., commercial sulphur, and non-corrosive boiler flue gas at 1500 p.s.i., for injection into the Embar-Tensleep reservoir completes the products.

The H_2S- and sulphur-recovery systems are described, and flow diagrams given. The former uses a two-stage amine process for sweetening, and the latter employs a modification of the Claus process.

Absorption, distillation, and fractionation systems produce the butane and propane. One of the plant boilers is designed for inert-gas generation, the gas being delivered to the field injection piping system at 1500 p.s.i. and 165° F for well-pressure maintenance.

Approximately ten days' storage facilities for each of the liquid products is available in 10 by 60-ft horizontal, cylindrical tanks.

Seven diagrams and two tables are provided. G. A. C.

Solvent Extraction and Dewaxing.

1446. Double Solvent Extraction of Residual Stocks. M. L. Cobb. *Petrol. Engr*, May 1949, **21** (5), C-47.—This Duo-Sol unit used propane as the paraffinic fraction solvent and Selecto, a mixture of 55–60% phenol and 40–45% cresylic acid, as the aromatics-naphthenics solvent. Seven extractors are used; propane is introduced at No. 1, the oil charge (residual and heavy distillate stocks) at No. 3, and the Selecto at No. 7. A detailed flow sheet is given, and the effect of the proportions of the two solvents and of the proportions of solvents to oil is illustrated by a table of the properties of the finished product. Operating conditions are given as well as details of shut-down and corrosion difficulties. G. K. A.

1447. Emulsion Deoiling of Crystalline Waxes. A. H. Schutte and K. E. Rose. *Petrol. Engr*, May 1949, **21** (5), C-7.—Unlike the conventional sweating process the new method is a continuous process and the processing time is measured in minutes. The oily wax is emulsified with water, a little air also being added, and then cooled to crystallize the wax. The oil–water emulsion is then filtered off. In practice the emulsification and crystallization is accomplished at the same time by direct addition

of cold water. The amount of water added controls the final temperature of the emulsion, and so serves as a control for various types of wax–oil feed.

Filtering is by a perforate-wall basket centrifuge or by a special solid-wall centrifuge designed for this process.

Plant data are given for operating with various types of wax on different sizes of plant. G. K. A.

Cracking.

1448. Platforming Improves Motor Fuels. E. F. Nelson. *Petrol. Engr*, Apr. 1949, **21** (4), C-22.—After tracing the trend in products the author considers the methods open to the medium-sized refinery to follow these trends. Catalytic cracking is usually the answer and the development of the process is outlined. Cracking catalysts, treating catalytically cracked gasoline, and reforming are all briefly considered. The platforming process is then introduced, this being a new process like hydroforming, *e.g.*, a catalytic process in which hydrogen recycle is employed to suppress carbon formation. The action is to convert naphthenes to aromatics, high-boiling paraffins to lower-boiling ones, and to isomerize low-boiling paraffins. The features of this process are: (1) large octane number gain; (2) low volumetric loss; (3) moderate plant and operating costs.

Tables are given showing the results of platforming on various crudes. G. K. A.

1449. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 613,463 of 8.12.48. Process for the catalytic aromatization or hydroforming of hydrocarbons.

Shell Development Co. B.P. 615,479 of 19.1.49. Method of conducting catalytic conversions.

J. C. Arnold (Standard Oil Development Co.). B.P. 615,647 of 19.1.49. Purification and reactivation of contaminated solid catalytic material.

A. S. Ramage. B.P. 616,346 of 2.2.49. Process for transforming hydrocarbon oils into other hydrocarbons having a lesser number of carbon atoms in the molecule.

Shell Development Co. B.P. 616,307 of 2.2.49. Catalytic cracking and catalysts therefor.

N.V. Internationale Hydro. Mij. B.P. 616,375 of 2.2.49. Destructive hydrogenation of petroleum oils.

Phillips Petroleum Co. B.P. 616,793 of 9.2.49. Catalyst regeneration.

Universal Oil Products Co. B.P. 617,284 of 16.2.49. Production of volatile hydrocarbons from hydrocarbonaceous solids.

Anglo-Iranian Oil Co., J. Owen, and O. M. K. Collis. B.P. 617,920 of 23.2.49. Hydroforming of normal hexane.

Shell Refining & Marketing Co., R. S. Cuis, and P. J. Garner. B.P. 618,189 of 2.3.49. Dehydrohalogenation processes.

J. C. Arnold (Standard Oil Development Co.). B.P. 618,313 of 2.3.49. Manufacture of alumina hydrosols. G. R. N.

Isomerization.

1450. Patent. Universal Oil Products Co. B.P. 613,684 of 15.12.48. Isomerization of mono-olefinic hydrocarbons. G. R. N.

Chemical and Physical Refining.

1451. Removal of Nitrogen from Natural Gas. H. N. Wade. *Oil Gas J.*, 23.6.49, **48** (7), 195.—Economic waste and processes available for removal of the high percentage of nitrogen expected in the natural gas from the Western Canada wells are discussed.

The presence of incombustibles in gas results in larger investment in pipe and compressors for transmitting a given amount of heating value, with a corresponding waste in operating expense.

Process available for removal of nitrogen include absorption, adsorption, diffusion and centrifugal methods, hydrate formation, and loss-temperature processing.
G. A. C.

1452. Patents. Shell Development Co. B.P. 613,229 of 8.12.48. Fluid separating means.

L. J. Derham and F. J. Johnson. B.P. 613,651 of 15.12.48. Removal of sulphur compounds from gases.

Universal Oil Products Co. B.P. 613,770 of 15.12.48. Extracting an aromatic hydrocarbon from a mixture containing other hydrocarbons.

C. Arnold (Standard Oil Development Co.). B.P. 614,626 of 31.12.48. Inhibiting the formation of froth in chemical processes.

Phillips Petroleum Co, B.P. 614,636 of 31.12.48. Refining of hydrocarbon distillates.

J. G. Fife (Shell Development Co.). B.P. 615,425 of 19.1.49. Method of contacting fluids one with another.

N.V. de Bataafsche Petroleum Mij. B.P. 616,735 of 9.2.49. Refining high-boiling dark-coloured mineral oils poor in aromatics.

N.V. de Bataafsche Petroleum Mij. B.P. 617,626 of 23.2.49. Apparatus for contacting liquids continuously and in countercurrent.

N.V. de Bataafsche Petroleum Mij. B.P. 618,029 of 2.3.49. Process and device for contacting liquids with gases.
G. R. N.

Special Processes.

1453. Gas Conserved to Make Chemicals. A. L. Foster. *Petrol. Engr*, Mar. 1949, **21**, (3), C-7.—In line with the policy of utilizing all oil and gas this plant, handling 100 million cu. ft. of stripped natural gas per day, produces natural gasoline and other related products. Low-octane-rating naphthas are catalytically reformed with bauxite, stripped gas is oxidized with 90–95% oxygen to yield aldehydes, alcohols, and acids. Flexibility at the plant permits the products to follow the market requirements. The oxygen is produced by liquefaction. Corrosion difficulties are overcome by using stainless steel for fittings and resin linings for the formaldehyde plant.
G. K. A.

1454. New Oxygen Process. Anon. *Petrol. Engr*, Mar. 1949, **21** (4), C-30.—The Elliott process has the following advantages: (1) no necessity for periodic shut-down to remove water and carbon dioxide; (2) immune from possible acetylene explosions; (3) will operate at reduced load without loss of efficiency; (4) process simplified and automatic.

Oxygen up to 99·5% purity can be made with high-purity nitrogen as a by-product. In the process air is compressed to 5 p.s.i., conditioned and cooled to below minus 300° F and charged to a single fractionating column. Oxygen is boiled off the reboiler, and nitrogen as overhead. The nitrogen cools the inflowing air.
G. K. A.

1455. Design of Water Gas Conversion Plants. R. W. Sherwood. *Petrol. Engr*, May 1949, **21**, (5), C-20.—The use of hydrogen is greatly increasing in the petroleum industry. The usual method of preparing is via water gas, either from light hydrocarbons and steam or oxygen either thermally or catalytically. This gas will contain up to 20–30% carbon monoxide, and to obtain a product of 99% purity hydrogen, this carbon monoxide is usually converted to hydrogen by the water-gas shift reaction

$$CO + H_2O = CO_2 + H_2 \quad . \quad . \quad . \quad . \quad . \quad (1)$$

This is an equilibrium reaction which by the addition of excess steam will reduce the CO to negligible proportions. This action is favoured by low-temp reaction and the required excess of steam also is reduced by working at low temp, hence a cat is required to reduce reaction time. A cat based on iron oxide is generally used, the temp being 750–950° F. After conversion the carbon dioxide is removed by the usual methods. For high-purity hydrogen this operation is repeated two or three times, this

being more economical than a single-pass process for the same purity of product. Purification of the product with reference to the removal of carbon dioxide, carbon monoxide, hydrogen sulphide, and organic sulphur compounds is described.

G. K. A.

1456. Patents. J. G. King, C. M. Cawley, J. H. G. Carlile, and F. E. T. Kingman. B.P. 613,505 of 15.12.48. Liquid fuel.

Anglo-Iranian Oil Co., S. F. Birh, and C. B. Collis. B.P. 613,867 of 15.12.48. Production of benzene.

Usines de Melle. B.P. 614,165 of 22.12.48. Hydration of olefins.

Standard Oil Development Co. B.P. 614,406 of 31.12.48. Process for the removal of wax contaminants from finely divided catalysts used in hydrocarbon synthesis processes.

Petrocarbon Ltd., V.R. Gray, and H. M. E. Steiner. B.P. 614,456 of 31.12.48. Oxidation of aliphatic olefin hydrocarbons.

Aktieselskabet Grindstedvaerket. B.P. 614,925 of 12.1.49. Method of producing emulsions of the oil in oil type.

J. C. Arnold (Standard Oil Development Co.). B.P. 615,381 of 19.1.49. Process for the catalytic synthesis of hydrocarbons.

J. C. Arnold (Standard Oil Development Co.). B.P. 615,984 of 26.1.49. Curing of hydrocarbon copolymers.

Phillips Petroleum Co. B.P. 615,229 of 19.1.49. Production of synthetic rubber.

C. Arnold (Standard Oil Development Co.). B.P. 616,499 of 2.2.49. Catalytic synthesis of hydrocarbons.

N.V. de Bataafsche Petroleum Mij. B.P. 616,276 of 2.2.49. Process for manufacturing valuable reaction products of high molecular unsaturated substances containing more than one unsaturated grouping in the molecule with inorganic acids or anhydrides.

Sharples Chemicals Inc. B.P. 616,521 of 2.2.49. Manufacture of mercaptans.

J. C. Arnold (Standard Oil Development Co.). B.P. 616,710 of 9.2.49. Production of hydrogen-containing gases.

J. C. Arnold (Standard Oil Development Co.). B.P. 617,351 of 16.2.49. Manufacture of hydrocarbon polymers.

M. S. Chowdhery. B.P. 617,869 of 23.2.49. Manufacture of activated carbon.

J. C. Arnold (Standard Oil Development Co.). B.P. 617,779 of 23.2.49. After treatment of copolymers.

C. Arnold (Standard Oil Development Co.). B.P. 618,068 of 2.3.49. Synthesis of hydrocarbons.

J. C. Arnold (Standard Oil Development Co.). B.P. 618,249 of 2.3.49. Low-temperature olefinic polymers.

N.V. de Bataafsche Petroleum Mij. B.P. 618,295 of 2.3.49. Process for increasing the rate of polymerization of diallyl phthalate.

G. R. N.

Metering and Control.

1457. Cost-imating Instrument Costs. W. L. Nelson. *Oil Gas J.*, 16.6.49, **48** (6), 141.—No. 35 in the series lists approximate costs of control instrument (material and labour) for 1946.

Instruments listed include thermocouples, temperature indicators, pressure gauges, flow recorders, and relief valves, etc.

G. A. C.

1458. International Standardization Progress. H. Hyams. *World Petrol.*, 1949, **20** (6), 50–52. The activities of the I.P. in the field of oil-measurement standardization are reviewed. It is believed that an accuracy of 0·1% may be achieved in routine

measurements without introducing cumbersome or costly techniques. A bibliography is appended. E. B.

1459. Use of Controllers with " Rate " Actions. Pt. I. V. V. St. L. Livy. *Petrol. Engr*, May 1949, **21** (5), C-13.—The control of many processes is improved by using a " derivative." The effect of the derivative is described and compared with proportional and reset. The application to " noisy " processes is discussed and also the correct method of setting a controller with proportional, reset and derivative response. The application of " derivative " control to various processes is discussed, the time lag is not a criterion, but the shape of the signature curve indicates the difficulties of the control and the justification of using a derivative controller. A table is given of the type of control required for various processes, the difficulties, notes on the operation and the possibility of the use of a derivative. For noisy processes it is possible, sometimes, to use a modified derivative control in which the derivative action is restricted to reduce excessive action of the controller. G. K. A.

Safety Precautions.

1460. Gas Extraction from Cylinders. Anon. *Mech. World*, 15.7.49, **126** (3261), 76.—One of the problems of the gas-works engineer is that of displacing air by gas or gas by air when putting into or out of commission new main, storage holder, or other unit through which passes large volumes of gas. Two dangers are explosion and poisoning hazards. When displacing air from new container by delivery gas at required pressure and displacing air through suitable vents, outlets should be fitted with flame traps. If oxygen content of sample from main has been reduced to about 1% by volume, main can be assumed to be sufficiently purged. Similar procedure used when clearing air from gas-holder. When analysis of contents of bell shows 95% gas and 5% air, vents can be closed and gas pressure raised to give maximum inflation. Similar methods are adopted when vessel has to be purged of gas by air or steam. Replacement of air by gas or gas by air must in all cases give rise to explosive mixtures at intermediate stage. Use of inert gas as intermediate between inflammable gas and air is reasonably satisfactory solution. Commonest inert gases are carbon dioxide and nitrogen, former being more effective for narrowing explosive range. Various sources of purging gas, including gas-purging machines are described. A. S.

1461. Fighting Oil Fires. Anon. *I.P. Review*, June 1949, **3** (30), 180.—Fires in pipelines and storage tanks are similar in character, and are encountered the world over. The chief necessity is to shut off the feed pipe, which is not the job of the fireman. Fires become hazardous only when charred, but unbroken lines are involved. It is sometimes possible to cool such lines and to extinguish the fire with spray or fog nozzles alone. If such nozzles are used together with foam, it is necessary to ensure that the cooling jets do not prevent the blanket of foam from forming over the fire and free oil. During the War, air or mechanically held foam replaced chemical foam. The advantage is increased mobility. Difficulties in firefighting at refineries were, of course, increased during the War due to loss of the usual services. A great deal was learned about wartime firefighting from a fire amongst storage tanks at Falmouth, and about peacetime fires from one on the tanker *Liseta* while in dock. The essential is always to be on the alert. R. H.

PRODUCTS.

Chemistry and Physics.

1462. The Solubility of Fluorocarbons. R. L. Scott. *J. Amer. Chem. Soc.*, 1948, **70**, 4090.—Solubility parameters (square roots of the internal pressure) have been calc for fluorocarbons, and are lower than any other substances liquid at room temp. From the Hildebrand solubility theory it is deduced that the aliphatic fluorocarbons are completely miscible with aliphatic hydrocarbons and ether, but show only limited solubility in benzene, acetone, etc. Experimental data confirm these predictions, leading to the conclusion that the solubilities of the fluorocarbons are not at all

anomalous, but are only the thermodynamic consequences of their low-solubility parameters. G. R. N.

1463. Heats of Combustion and Isomerization of the Six C_7H_{14} Alkyl*cyclo*pentanes. W. H. Johnsen, E. J. Prosen, and F. D. Rossini. *National Bureau of Standards*, Mar. 1949, **42** (3), 251.—Calorimetric measurements have been made which yield values for the differences in the heats of combustion or the heats of isomerization of the six C_7H_{14} alkyl*cyclo*pentanes in the liquid state at 25° C. These values were combined with values for the differences in the heats of vaporization of these isomers at 25° C to obtain values for the heats of isomerization in the gaseous state at 25° C. Utilizing values previously reported for the heats of combustion and formation of ethyl*cyclo*pentane in the liquid and gaseous states at 25° C, corresponding values were obtained for the five dimethyl*cyclo*pentanes in the liquid and gaseous states at 25° C. A. S.

1464. Heat of Isomerization of the Two Butadienes. E. J. Prosen, F. W. Maron, and F. D. Rossini. *National Bureau of Standards*, Mar. 1949, **42** (3), 269.—Work carried out is part of thermochemical investigation of monomeric compounds of importance in national synthetic-rubber programme. Calorimetric measurements yield a value for difference in heats of combustion at constant pressure of 1 : 3-butadiene and 1 : 2-butadiene in gaseous state at 25° C. Combination of this value with the heat of formation of 1 : 3-butadiene yields values for heats of formation and combustion of 1 : 2-butadiene. Combustion of the gaseous hydrocarbon occurred in a flame at constant pressure in a glass calorimetric reaction vessel of improved design. A complete description is given of the new calorimetric vessel.

Following experimental value is reported for reaction of isomerization :—

$$1 : 3\text{-butadiene (gas)} = 1 : 2\text{-butadiene (gas)}, \Delta H^\circ \text{ at } 25^\circ\text{ C} = 12{\cdot}78 \pm 0{\cdot}16 \text{ k.cal/mol}$$

$$4C(\text{Solid, graphite}) + 3H_2\ (\text{gas}) = C_4H_6\ (1 : 2\text{-butadiene, gas}), \Delta H^\circ \text{ at } 25^\circ\text{ C} = 39{\cdot}53 \pm 0{\cdot}28 \text{ k.cal/mol}$$

$$C_4H_6\ (1 : 2\text{-butadiene, gas}) + 5\tfrac{1}{2}\ O_2\ (\text{gas}) = 4CO_2\ (\text{gas}) + 3H_2O\ (\text{liquid})$$

ΔH° at 25° C $= -620{\cdot}69 \pm 0{\cdot}28$ k.cal/mol. A. S.

1465. The Relationship of Physical Properties and Ultimate Analysis for Liquid Hydrocarbons. H. R. Linden. *Oil Gas J.*, 7.7.49, **48** (9), 60.—The clarification of the problem of the inter-relationship of physical properties of liquid hydrocarbons with their chemical composition by a completely empirical approach is presented without introducing new variables and with some mathematical changes in established functions.

Having been shown that apparently unrelated properties of liquid hydrocarbons such as their heat of formation, heat of combustion, sp. ht., and max flame temperature, for example, are all functions of the C/H ratio, a criterion based on simple physical tests which correlates with the C/H ratio is valuable.

Four figures and two tables illustrate the work. G. A. C.

1466. Thermodynamic Properties and Molecular Structure of *cyclo*Pentene and *cyclo*Hexene. C. W. Beckett, N. K. Freeman, and K. S. Pitzer. *J. Amer. Chem. Soc.*, 1948, **70**, 4227.—By the use of bond bending and bond twisting (internal rotation) potential constants from related molecules the potential or strain energy of *cyclo*pentene and *cyclo*hexene was calc for various configurations. It was found that *cyclo*pentene can pucker by moving the carbon opposite to the double bond out of the plane of the other four carbon atoms by about 0·3 Å without significant change in energy from the planar configuration. *cyclo*Hexene, by contrast, shows two tautomeric forms related to chair and boat *cyclo*hexane which differ by about 2–7 k.cal/mol. The available Raman and infra-red spectroscopic data are interpreted for *cyclo*pentene and *cyclo*hexene. With reasonable adjustments of otherwise somewhat uncertain parameters, agreement is obtained with the thermodynamic data for the two substances. G. R. N.

1467. Vanadium Oxides, Hydrogenation Catalysts. II. V. I. Komarewsky and J. R. Coley. *J. Amer. Chem. Soc.*, 1948, **70**, 4163.—The formation of the vanadium–olefin

complex in the chemisorption of olefins on vanadium oxide may be effected with very little distortion of the valence angle. The reaction temp at which vanadium oxide gives max activity as a hydrogenation catalyst corresponds closely with the reduction temp of vanadium pentoxide to vanadium oxide. G. R. N.

1468. Theory of Molecular Distillation and its Experimental Verification. R. S. Bradley and A. D. Shellard. *Trans. Far. Soc.*, 1949, **45**, 501–505.—Mixtures of n-$C_{16}H_{34}$ with n-$C_{14}H_{30}$ and with n-$C_{18}H_{38}$ were dist in a mol still at 40 and 46° C respectively. The theory of molecular dist is discussed and shown to be applicable to the two binary mixtures. V.p. of n-$C_{14}H_{30}$ and n-$C_{18}H_{38}$ were determined, using the Knudsen technique, and found to be for n-$C_{14}H_{30}$ $(6{\cdot}08 \pm 0{\cdot}05) \times 10^{-3}$ at 40° C and for n-$C_{18}H_{38}$ $(3{\cdot}82 \pm 0{\cdot}03) \times 10^{-3}$ at 46° C (cm. Hg.). E. B.

1469. Experimental Researches on Combustion Mechanism in the Gas Phase. G. Pannetier. *Rev. Inst. franç. Pétrole*, 1949, **4**, 166–179, 207–239.—Various combustion theories are discussed. The existence of the ClO radical in an H_2 flame burning in Cl_2 and O_2 has been confirmed. The combustion mechanism of methyl chloride is examined and that of cyanogen in O_2, including the effect of adding small amounts of halogens, is considered in some detail. Possible reaction mechanisms are put forward, and the existence of the radicals CI and CBr is postulated. The second part of the paper is concerned with a study of the conditions governing the combustible limits of hydrocarbons and other gases. The apparatus used is described, the combustion tube is 60 cm long and 10–35 mm dia. Studies of the inflammability range of air–C_2N_2 mixtures showed the marked influence of water vapour and combustion-tube dimensions. Dimethyl ether and acetylene (both pure and containing traces of acetone) were examined, and flame velocities in air–methane mixtures were measured. The results are discussed at length, various reactions involving free radicals being taken as the basis of the differences observed. Nitrogen of air cannot be considered merely as a diluent, but exhibits some inhibiting action. The physical state of the combustion-tube walls is an important factor. It is concluded that variations in the combustion mechanism can markedly affect the inflammability limits. Fifty-two references. V. B.

Analysis and Testing.

1470. A Simple Method for Assaying Contact Toxicities of Insecticides, with Results of Tests of Some Organic Compounds against *Calandra Granaria L.* A. Stringer. *Annals appl. Biology*, June 1949, **36** (2), 213.—The deposition of a known weight of insecticide in a volatile solvent on a standard substrate is the simplest method of testing contact toxicity.

Test insects were adult grain weevils (2–4 weeks old) reared on wheat in glass jars at 25° C. No. 1 Whatman filter-papers were just flooded with 0·5 ml of acetone; therefore, by using insecticide–acetone solutions of known concentration, deposits of known weights of insecticides were obtained after solvent evaporation.

In the oil-film technique the insecticide was dissolved in oil, usually P. 31 petroleum oil. The prepared paper was aged 24 hr before use.

The calculated probit-log (dosage $\times 10^7$) regression line was obtained for all concentrations of insecticides tested. Tests were made on the dry deposits of D.N.C., D.D.T., phenyl mercury derivative of D.N.C., phenyl diazopiperidine, tetra-nitrocarbazole, and others.

D.N.C. (di-nitro-ortho-cresol) proved quite satisfactory. D.D.T. gave no variation of kill with variation of dosage, but further work is being carried out. Tabulated data of results obtained are presented.

Results of tests with insecticidal oil films where the insecticide is D.D.T., Toxaphene, E. 605, or chlordane are given.

Certain concentration D.D.T. films show a concave curve for probit mortality against log deposit; but a combination of two linear regression lines can be made to fit the data. D. K.

Gas.

1471. Questions and Answers on Propane and Butane Fuels. J. F. Barkley. *U.S. Bur. Mines Inf. Circ.* 7519, May 1949, Pp. 9.—A series of questions and answers based on inquiries received by the Bureau on the use of propane and butane fuels. G. S.

1472. Patents. Koppers Co. Inc. B.P. 613,533 of 15.12.48. Recovery of light oil from absorbent.

Compagne française de Raffinage. B.P. 618,254 of 2.3.49. Method of ensuring the safety of tanks containing liquefied gases. G. R. N.

Engine Fuels.

1473. National Motor-Gasoline Survey, Winter 1948–49. O. C. Blade. *U.S. Bur. Mines Rep. Invest.* 4567, July 1949, pp. 33.—The average O.N. (M.M.) of 3811 motor fuels marketed throughout the U.S.A. during the winter 1948–49 was 79·7, compared with 79·4 for the previous winter. Averages for regular-priced grades were M.M. 75·6, R.M. 80·5, and for premium-price grades were M.M. 79·7, R.M. 86·5. Averages for other properties were :—

	Regular.	Premium.
Reid vapour pressure . . .	10·2 lb	10·4 lb.
A.P.I. gravity	62·0°	62·5°
Sulphur	0·092%	0·076%
Gum	2·1 mg/100 ml	2·2 mg/100 ml
T.E.L. content	1·35 ml/U.S. gal	1·88 ml/U.S. gal

G. S.

1474. Explosive Properties of Hydrazine. F. E. Scott, J. J. Burns, and B. Lewis. *U.S. Bur. Mines Rep. Invest.* 4460, May 1949, pp. 18.—In view of the interest in hydrazine and 85% hydrazine hydrate as fuels, information has been obtained on their explosive properties. When a 5-g weight was dropped from 1 m into a 0·01 g sample of either material there was no indication of explosion, nor did the pendulum friction-tester show any explosion, burning, or local cracking. In the ballistic mortar, 10-g samples of hydrazine showed 135% of the strength of 10-g charges of T.N.T. The detonability could not be determined in the Mettegang recorder. The sensitivity to initiation by static sparks was the same for both hydrazine and hydrate. Ignition temperatures in a Pyrex flask for hydrazine (270° C in air; 204° C in O) and for hydrate (292° C and 218° C) were normal. In platinum or stainless steel, results were erratic.

Hydrazine has a lower limit of inflammability of 4·67 by vol in air and an upper limit of 100%. G. S.

Lubricants.

1475. Principles of Diesel Lubrication. S. J. M. Auld and C. Lawrie. *Mech. World*, 8.7.49, **126** (3260), 46.—The paper deals first with general principles of lubrication and subject of additives including, in particular, anti-oxidants and detergents. An explanation is given of theory of boundary lubrication as put forward by Hardy, and modifications to this particular conception resulting from work and views of more recent experiments such as Beeck and Bowden are given. Question of water contamination of oil is discussed. It is recommended that oil temperature should be kept at not less than 130° F. Certain additives now used in diesel oils may also render new oils more emulsifiable. Water also often causes oil frothing and crank-chamber corrosion.

Advance in design and operation of small high-speed diesels has often led to correspondingly severe demands in performance. Chief of newer problems is prevalence of ring-sticking and lacquer deposition, due chiefly to higher temperatures. There is also greater tendency to corrosion of hard alloy bearings and increased wear of scuffing type. Plain mineral oils are quite incapable of coping with these objectionable phenomena. Detergents added are frequently very high-molecular-weight metallo-organic compounds, and their effects are very marked. Unfortunately they may also be pro-oxidants, and so must be used in conjunction with powerful anti-oxidants. Combination of these two comprises the " heavy duty " additive. A. S.

1476. Gear Wear as Related to the Viscosity of the Gear Oil. H. Blok. *Ingenieur*, No. 25, 24.6.49, 039–46 (article in English).—The article deals with the effect of the

viscosity on types of gear wear and principles employed in the testing of gear oils, two examples of the latter being fully discussed :—

1. In gears subject to influences causing chattering, the viscosity was found to be a property of extreme importance in gear wear. This is explained by considering the main function of the gear oil, *i.e.*, a damping or cushioning action between the gear-teeth. In this case, the article points out, the effect of E.P. additives is of secondary importance.

2. Although the load-carrying capacity of gears is beneficially affected by both the viscosity as a hydrodynamic factor and the anti-welding action of the oil, when assessing the anti-welding action on test machines the viscosity should not be allowed to influence the result. The new test method of achieving this is described.

Charts and diagrams illustrate the article. A. H. B.

1477. Development of Lubricating Greases. E. R. Matthews. *Petrol. Engr*, May 1949, **21** (5), C-41.—The first satisfactory grease was "cup grease" made with a calcium base. Later a sodium-base grease was introduced which had a high dropping point (melting point) but poor resistance to water. The method of pumping grease with a gun through a check valve was then introduced and for this a soft grease, made with a lighter oil, was produced. To meet the high loads and speeds of automobile bearings E.P. lubricants, a grease containing a sulphurized fat was introduced and on the introduction of the "hypoid gear," lead soap was added to gear oil together with an E.P. additive to make a suitable lubricant.

1924 saw the introduction of aluminium-base greases, which were transparent and had good water resistance; mixed with sodium-based grease a product of good water resistance, heat resistance, and containing a high oil content was produced. For aeroplane use from temp of 65° below zero to tropical summer temp a lithium-base grease using a very light viscosity oil was produced. In 1943 a barium-base grease appeared, the properties of which made it suitable for most purposes. Other greases recently produced for special purposes are zinc-base, calcium–fatty acid, strontium-base, lithium multi-purpose, and silicone lub. greases. The latter name is derived from the fluid lubricant and not the base. G. K. A.

1478. Patents. Anglo-Saxon Petroleum Co. and J. A. Bell. B.P. 613,706 of 15.12.48. Lithium base lubricating greases.

N.V. de Bataafsche Petroleum Mij. B.P. 614,667 of 31.12.48. Lubricating pumps.

Anglo-Saxon Petroleum Co. and W. Davey. B.P. 615,117 of 12.1.49. Lubricating oils and greases.

Carbide and Carbon Chemicals Corpn. B.P. 615,188 of 12.1.49. Lubricating grease compositions.

J. C. Arnold (Standard Oil Development Co.). B.P. 615,564 of 19.1.49. Manufacture of lubricating greases.

Compagnie française de Raffinage. B.P. 615,936 of 26.1.49. Method for lubrication.

Girdler Corpn. B.P. 616,341 of 2.2.49. Manufacture of lubricating grease.

C. C. Wakefield & Co., E. A. Evans, and J. S. Elliott. B.P. 616,881 of 9.2.49. Lubricating compositions.

C. Arnold (Standard Oil Development Co.). B.P. 617,404 of 16.2.49. Cutting lubricants.

C. C. Wakefield & Co., E. A. Evans, and N. E. F. Hitchcock. B.P. 618,085 of 2.3.49. Lubricating and protective oil compositions. G. R. N.

Special Hydrocarbon Products.

1479. Acetylene Black. A Large-scale Example of a Turbulent Flame-reaction. J. Wotschke and K. Paasch. *Schweiz. Arch. Ang. Wiss. Tech.*, 1949, **15**, 175–187.—Acetylene black is formed according to the reaction $C_2H_2 \rightleftharpoons 2C + H_2 + 55$ k.cal.

The yield is 1 kg black per m^3 of acetylene. A description is given of suitable cracking plant; extremely high gas velocities are encountered, the Reynolds No. being 190,000. Reaction temp can attain 2250° C, the acetylene being heated to 800° C to initiate the decomposition. Hydrogen is used as a diluent in the cracking reaction. Thermodynamic aspects of the process, the temp distribution at various parts of the cracking tube, and heat-transfer data are considered in some detail. Lay-outs are shown for pilot (15 kg/hr) and industrial (500 kg/hr) installations which have been operated in Germany. Yields are 94–95%. The cost of the acetylene represents two-thirds of the operating cost. V. B.

1480. Paraffin Wax in the Male Bladder. T. J. D. Lane. *Brit. Med. J.*, 1949, ii, 216.—A case report on the use of liq. paraffin (sp. gr. 0·850) in aiding the removal from the bladder of a foreign body (paraffin wax) lighter than water but not floating in the liq. paraffin. V. B.

Derived Chemical Products.

1481. Chemicals from Petroleum. Anon. *Times Rev. Ind.*, 1949, Aug., 45–51.—An illustrated description of the new Shell plant at Stanlow. 100,000 tons p.a. of Venezuelan gas oil feed is to yield 20–24% of solvents derived from propylene (*iso*propyl alcohol, *iso*propyl ether, acetone, diacetone alcohol, methyl*iso*butyl-ketone) and butylene (*sec*butyl alcohol, M.E.K.). 19% of the feed is converted into aromatic dist (hydrogenated for motor spirit) and the balance is fuel (liquid and gas). Plant cost was £4 million, average value of the solvent products is estimated at £100/ton. Personnel numbers approx 200. Economic aspects (dollar saving, etc.) of the plant are discussed. V. B.

1482. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 613,424 of 8.12.48. Production of mahogany acids and their soaps.

Shell Development Co. B.P. 615,571 of 19.1.49. Production of unsaturated alcohols. G. R. N.

Coal, Shale, and Peat.

1483. Experimental Shale Refinery Completed. H. B. Morris and D. L. Gilbertson. *World Petrol.*, 1949, **20** (6), 46–49.—The U.S. Bureau of Mines plant (Rifle, Colorado) for processing shale oil is described. With only minor changes either atm dist, reforming, single-coil recycle cracking, or delayed coking may be performed with the same equipment. Provision is made for treating and re-running distillates. The min practical size of tube-still heater was adopted, and heater capacity rating was thereby determined at 300 b.d. Design capacities for most of the equipment were determined by the delayed coking scheme (200 b.d. raw shale oil permitting 100 b.d. recycle), and mechanical design specification was determined by the more severe conditions of recycle cracking (50 b.d. raw charge, 250 b.d. recycle). A flow diagram is given with a description of the size, design, and material of construction. The chemical treating unit provides for dil NaOH and dil H_2SO_4 followed by a 3-stage countercurrent extraction with conc H_2SO_4 at reduced temp for sulphur removal and colour and stability improvement. After washing the product is redist prior to "doctor" treatment. Mixing-in of the conc H_2SO_4 is by centrifugal pump, jet pumps are used elsewhere. E. B.

1484. Oil Shales in Carpathian Mountains. Z. Pazdro. *Nafta*, May 1948, **4**, 161–164.—A review of the ways in which the problem of shortage of oil is tackled in other countries. The conclusion drawn is that the Carpathian shales should not be forgotten since they are rich and easily accessible. Two samples are analyzed for oil, ash, moisture, and mineral content. Extensive geological bibliography is appended. M. S.

Miscellaneous Products.

1485. Acrylic Resins (Part 1). C. T. Kautter. *British Plastics*, June 1949, **21** (241), 332.—The classic synthesis of acrylics is from ethylene through its chlorhydrin, oxide,

and cyanhydrin. Acrylonitrile can be produced directly by reaction between acetylene and prussic acid. Preparation of methacrylics proceeds along somewhat similar lines. Acetone and prussic acid react to give acetone cyanhydrin, which, when reacted with sulphuric acid, yields methacrylamide.

The casting and moulding of these resins present difficulties due to large shrinkage during polymerization. These have been overcome by construction of moulds which contract at the same rate as the polymerizing resin.

The article also discusses the theory and practice of the final polymerization of the moulded articles, particularly the manner in which the rate of polymerization is maintained at a suitable level. O. M.

1486. Cold Rubber Manufactured at Copolymer's Baton Rouge Plant. L. S. McCaslin. *Oil Gas J.*, 30.6.49, **48** (8), 60.—Eight medium-sized tyre companies operating as Copolymer Corporation run the plant at Baton Rouge for the production of 60 million lb p.a. of " cold rubber by polymerization " of butadiene and styrene at 41° F.

The reaction takes place in soapy water to which small amounts of activator and catalyst solutions have been added, together with a modifier to control toughness of product.

Excess butadiene is flashed off at reduced pressures, and excess styrene removed by steam stripping. The stripped latex is mixed with anti-oxidant solution, brine, and dilute acid in the coagulation pumps, which causes the rubber to separate from the latex. The rubber crumb is finally produced in 75-lb bales.

Initial production problems are reviewed, and development of cold rubber and its future traced. G. A. C.

1487. New Developments in Cold Rubber. Anon. *World Petrol.*, May 1949, **20** (5), 50.—Speed-up chemicals known as Diox initiators are being used in cold-rubber production. Cold rubber can now be made in 75 min at 14° F instead of 14–16 hr and in 5 hr instead of 25–30 hr at −4° F.

A new high-abrasion furnace black compounded with cold rubber gave a product 30% superior to natural rubber in road tests.

Present problems include the preparation of rubbers serviceable at low temperatures. The Diox systems are expected to contribute largely to their solution, since the advantages of low-temperature operation are obtained without sacrificing reaction rate and plant capacity. C. G. W.

1488. New Styrene-base Moulding Material. Anon. *Mod. Plastics*, July 1949, **26** (11), 68.—Plexene TA, a general-purpose powder, comprising a styrene-base copolymer thermo-plastic, is outstanding for the following properties: high impact strength and dimensional stability—it does not contain plasticizers—high chemical resistance, good electrical properties, etc. Special conditions are recommended for moulding this powder. It is possible to modify the copolymer to meet special requirements. O. M.

1489. Production of Synthetic Fuel (Petroleum) from Molasses. M. L. Joshi, K. C. Gulati, and B. Bhushan. *Indian Minerals*, 1948, **2**, 112–119.—Using specially designed apparatus, molasses, and lime (34·72% available CaO) in the proportion of 100 : 44 were heated at 450–480° C and yielded 11–12% wt of crude oil containing 32·5% gasoline and 27·5% kerosine, with pitch and a possible lub. oil. The gasoline was unstable and rapidly formed gum with deterioration in colour. G. S.

Engines and Automotive Equipment.

1490. Engines of the XVIIIe Salon de L'Aeronautique. *Aircr. Engng*, July 1949, **21**, 204.—A description is given of some of the newer engines exhibited at the Grand Palais, including exhibits by Ambrosini, Armstrong-Siddeley, Bristol, Mathis, Moteurs Potez, S.N.E.C.M.A. I. G. B.

1491. Diesel Engine Supercharging. F. V. Cook. *Pipe Line News*, June 1949, **21** (6), 15.—The Buchi principle of increased valve overlap and multiple exhausts for supercharging large diesel engines has been widely used.

The Stanolind Pipe Line Co. installed turbochargers, and the article deals with experience with the turbochargers. It was found that with two-inlet machines on five-cylinder engines incomplete scavenging of one cylinder occurred.

A pressure increase on a main line of 250 p.s.i. required an 84% increase in output of engines. Most of this was obtained by supercharging. At present seventy Buchi supercharged engines are in service or on order.

The increased h.p. obtained by supercharging cost from $35 to $50 per h.p. compared with $250·0 per h.p. for new diesel-driven pumping equipment. Maintenance of the superchargers costs less than maintenance of additional cylinders.

C. G. W.

1492. Optimum Power Regulation of a Carburettor-type Automobile Engine. E. A. Chudakov. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1949, 644–656.—Studies were made on a single-cylinder test engine of means whereby the increase in sp fuel consumption with decrease in engine load could be diminished. Two methods were examined, quant (normal throttling) and qual (mixture weakening). The efficacy of the latter increases with decreasing mol. wt. of the fuel, being at a max when methane is used. Indicator diagrams (taken with a piezo-electric head and a cathode-ray oscillograph) are shown for both methods at various engine loadings. Mixture weakening decreases rate of burning of fuel, but increases completeness of combustion. A combination of the two methods is most effective, and curves are given whereby such combination may be determined for various load factors. V. B.

1493. Patents. G. H. C. Rawlinson. B.P. 614,341 of 31.12.48. Liquid fuel systems for gas turbines.

Texaco Development Corpn. B.P. 615,724 of 26.1.49. Regulating the fuel supply of internal combustion engines.

Shell Refining and Marketing Co. and J. Lamb. B.P. 616,908 of 9.2.49. Fuel supply installations for Diesel engines.

Texaco Development Corpn. B.P. 617,890 of 23.2.49. Fuel injection system of an I.C. engine and the method of operation.

Anglo-Iranian Oil Co. and H. B. Taylor. B.P. 618,233 of 2.3.49. I.C. engines having fuel metering pumps. G. R. N.

MISCELLANEOUS.

1494. Book News. *Ingenieur*, No. 27, 8.7.49, W. 61.—*Die Kreiselpumpen fur Flussigkeiten und Gase.* By C. Pfleiderer—2nd Edition, 1949. *Centrifugal Pumps for Liquids and Gases.* The original edition published in 1932 has been brought up to date and is given a good recommendation. A. H. B.

1495. Claude Bonnier National Research Establishment. Anon. *Rev. Inst. franç. Pétrole*, 1949, **4**, 251–272.—An illustrated description of this station, situated near Paris and forming one of the five research establishments operated by the Institut Français du Pétrole. The station is devoted to the study of fuels and lubricants in I.C. engines, and is divided into three main sections—research, control, and education—of which the first is the largest. As well as numerous types of engine tests, fundamental work on thermodynamics, combustion, and friction is also carried out.

V. B.

1496. The Corrosion of Metals. W. H. J. Vernon. *J. Roy. Soc. Arts*, 1.7.49, **97** (4798), 578 (32 pp.).—The economics of corrosion are first considered, and this is followed by explanations of immersed and atmospheric corrosion together with their controlling factors. The question of surface films is then studied, and reference made to several classic works on this subject. The influence of atmospheric pollution and humidity is explained, and curves show the effect on corrosion of mild steel of varying amounts of SO_2 pollution over a range of relative humidities. A brief description is given of the way in which corrosion may be distributed on or in the metal, and this is followed by a consideration of underground corrosion. Methods of preventing corrosion are based

on : (i) modifications of design ; (ii) modifications of environment ; (iii) modifications of metal and (iv) protective coatings.

These preventive methods are dealt with individually, and various examples are given to demonstrate effect of structure design, considerations of surface condition, method of cathodic protection, water treatment (pH control, de-aeration, etc.), corrosion inhibitors, enclosed air spaces, purity of metal, use of corrosion-resistant alloys, and of natural or artificial coatings of reaction products, use of paint and other organic coatings, metal and miscellaneous coatings. A. S.

1497. Effect of Soap on Skin. Beneficial and Adverse Effects as Determined by Exposure Tests. J. A. Killian and M. E. Marsh. *Soap Sanitary Chem.*, June 1949, **25** (6), 44.—The problems associated with the action of soap on the skin are attributed to : (*a*) the variety of possible ingredients in commercial soap ; (*b*) the fact that soaps are tested in aqueous solutions, whose physical structure and chemical properties when in contact with the skin are largely unknown ; (*c*) the exhibition by soaps of indirect actions secondary to detergent capacities.

It is believed that the correlation of results of two supplementary methods will contribute to the summation of information of the actions of soap on the skin.

Soaps are classified as primary cutaneous irritants or mild detergents.

The only adverse actions of soaps revealed by patch tests are acute responses of the cutaneous vascular system.

Exposure tests are described, which replace patch tests ; these were performed on animals and human beings. The hands of the test subjects were immersed in two different soap solutions for varying periods.

In all tests one soap was taken as standard. A few representative series of test have been selected to illustrate technique and criteria adopted in interpretation of results. D. K.

1498. Employee Training Programme. Anon. *Petrol. Engr*, Feb. 1949, **21** (2), C-7.—The training programmes of two companies are discussed, the aims of both being top employee efficiency and max economy in operation. Benefits are that : (1) trainees have better knowledge of fundamentals, (2) they learn more quickly and require less " on-the-job " instruction, (3) take more interest. Classes are usually eight to twelve men and eleven classes are held on various subjects. The instruction includes class-room lectures, films, and field trips, and the course finishes with a " true or false " type examination. G. K. A.

1499. Peak Profits for Oil in 1948 Were Largely Reinvested. H. E. Rose. *World Petrol.*, 1949, **20** (6), 54–57.—A financial review is given of about thirty U.S. companies with regard to capital, income, and profits in 1948, comparing the 1948 position of some twenty-five of the companies with the previous four years. E. B.

1500. Refinery Process Costing. E. J. Jones. *I.P. Review*, June 1949, **3** (30), 175.—Process costing does not include the establishment charges which are applicable to the refinery as a whole, and are therefore not conveniently allocated to the various processes. The cost of any particular process may involve the cost of transferring the product to the next process—the rule is that " the sender pays." A cost statement for a particular process is the total expense of the process for a given period of time related to the quantity of product obtained. The total expense is made up of the following : salaries (these are allocated in proportion to the amount of time each salaried official spends on the particular process) ; wages (based upon the time-sheets of the workmen involved) ; materials (the benefits of these may be longer than the unit of time involved in the costing process, and so costs may be spread over a period of time) ; stores (again it is sometimes necessary to split these charges over a number of processes) ; fuel (this is easily allocated) ; chemicals (again easily allocated).
R. H.

1501. Report of Petroleum and Natural Gas Division, Fiscal Year 1945. R. A. Cattell and others. *U.S. Bur. Mines Rep. Invest.* 7505, June 1949. Pp. 22.—During 1945 the work of the division was mainly on problems related to the war effort, and the investigations carried out are briefly described under the headings of oil and gas development

and production, secondary recovery, chemistry and refining, thermodynamics of petroleum, and helium production. Illustrations of apparatus are given, as also are references to published reports. G. S.

1502. Report of Petroleum and Natural Gas Division. Fiscal Year 1946. R. A. Cattell and others. *U.S. Bur. Mines Rep. Invest.* 7506. June 1949. Pp. 52.—With the change from war assignments to normal functions a concerted effort was made to evaluate the results of the divisions' war activities on the basis of their value to the future economy of the U.S.A. Work done and to be done in this direction is outlined. G. S.

1503. Trend toward Larger Lube-oil Plants Revealed in Recent N.P.A. Survey. G. Weber. *Oil Gas J.*, 16.6.49, **48** (6), 82.—A survey by the National Petroleum Association (U.S.A.) of domestic facilities for manufacture of lub. oils is given.

Three tables show classification of lub.-oil plants by production capacity, geographical classification, and type of process (solvent extraction and dewaxing, and propane deasphalting), etc.

67·5% of total capacity is by 2500-b.d., and greater, units. G. A. C.

BOOK REVIEWS.

The Chemistry and Uses of Insecticides. E. R. De Ong. New York: Reinhold Publishing Corporation, 1948. London: Chapman and Hall Ltd. Pp. viii + 345. 36*s*.

This book provides a welcome change from the all too frequent haphazard compilations of literature references. The fact that the author is one of the pioneers in the scientific approach to pest control has ensured that this is a critical and judicious selection of information, enriched by the author's experience.

It provides information on the chemical and toxic properties of insecticides, particularly the newer ones, primarily for agricultural purposes. Practical data on dosages to be used with different insects, cautions to be observed, and methods of application are included, these being mainly based on Western U.S.A. practice. No attempt is made to cover other branches of the subject, such as spraying equipment, theories of insecticidal action, or evaluation methods.

The treatment is straightforward, chapters dealing with the inorganic insecticides, mineral and other oils, fumigants, plant derivatives and synthetic organic compounds. An unusual aspect covered in the final chapter is the use of heat, cold, and radiation as insecticides. An appendix provides a variety of data on legal requirements, antidotes, conversion tables, etc. The chapter on mineral oils gives a useful review of work on the desirable properties of mineral oils, particularly as far as the relation between chemical composition and physiological properties is concerned, the only criticism being the absence of reference to recent work, since 1944, on this subject, such as that by Chapman and Pearce.

The book will be of undoubted value to agriculturalists and orchard growers wishing for precise information on products used in pest control, to insecticide manufacturers and research students, of which the last-mentioned may derive encouragement from the formidable list of synthetic organic insecticides, many of which have already won their place in industry. In particular, the excellent and extensive bibliographies given at the end of each chapter will be of great assistance to those wishing to study a particular aspect of the subject in more detail. C. L. G.

British Petroleum Equipment, 1949. London: The Council of British Manufacturers of Petroleum Equipment, 1949. Pp. 524. £1 10*s*.

The 1949 edition of this valuable guide to the manufacturers of petroleum equipment made in the United Kingdom is a worthy successor to the first edition which made its appearance in 1947.

While this new edition follows the lines of its predecessor it has an additional seventy-four pages devoted to the displayed announcements of the members of the Council.

Following a list of the 300 members of the Council is an index to the classified list of their manufactures, and this classified list itself covers twenty-six pages. The products are listed under about one thousand sub-headings, the main headings varying from complete plants to small tools, while the sub-headings range from accumulators (hydraulic) to woven wire cloth, including such items as airfields' moorings, slipways, etc. Thus, this list is an extremely useful guide to anyone requiring material for practically every operation in the oil industry.

The 475 pages devoted to displayed announcements are a veritable mine of information on sizes, purposes, rated performances, etc., of a wide variety of equipment and should be of considerable value to engineers and technical personnel throughout the industry. G. S.

BOOKS RECEIVED.

Annual Report of the Research Council of Alberta, 1948. Edmonton: Research Council of Alberta, 1949. Pp. 28.

Investigations for 1948 included work on bituminous sands, fuels, geology, natural gas, soils.

British Standards Yearbook, 1919. London: British Standards Institution, 1949. Pp. 362. 5*s*. net.

Contains the latest information up to December 31, 1948, on British Standards.

B.S. 1580 : 1949. Unified Screw Threads. London: British Standards Institution, 1949. Pp. 88, 7*s*. 6*d*. net.

This specification, which was prepared by a joint B.S.I/Services Committee, will be reviewed at the end of six months before confirmation as one of the series of British Standards for screw-threads. It relates to parallel screw-threads and includes: (i) a coarse series from $\frac{1}{4}$ to 4 in dia, (ii) a fine series from $\frac{1}{4}$ to $1\frac{1}{2}$ in dia, and (iii) a special series from $\frac{1}{4}$ in dia upwards.

B.S. 1563 : 1949. Cast Iron Sectional Tanks (Rectangular). London: British Standards Institution, 1949. Pp. 34. 5*s*. net.

This applies to cast-iron sectional rectangular tanks built of plates 2, 3, or 4 ft square throughout.

B.S. 1564 : 1949. Pressed Steel Sectional Tanks (Rectangular). London: British Standards Institution, 1949. Pp. 19. 3*s*. net.

This applies to pressed mild-steel rectangular tanks built up of plates 4 ft square.

European Recovery Program. Petroleum and Petroleum Equipment Commodity Study. Washington, D.C.: Economic Co-operation Administration, 1949.

Discusses the supply of petroleum and petroleum equipment of all sorts to the countries participating in the Marshall Plan. Tables of statistics are included.

Financial Analysis of Thirty Oil Companies for 1938. Joseph E. Pogue. New York: Chase National Bank, 1949. Pp. 19.

International Council of Scientific Unions. Report of the Executive Committee, 1948. F. J. M. Stratton. Cambridge: the Council, 1949. Pp. 110 + vii. 5*s*.

The Role of Very Fine Mineral Matter in the Hot Water Process as Applied to Athabaska Bituminous Sand. K. A. Clark and D. S. Pasternack. Edmonton: Research Council of Alberta, 1949. Pp. 22. 15c.

Tanker Fleet. Stanton Hope. London: The Anglo-Saxon Petroleum Co., 1948. Pp. 124 + xiv.

This is, as its sub-title states, the war story of the Shell tankers and the men who manned them. It is a record of bravery and achievement which makes thrilling reading.

Times' Forelock. George P. Kerr. London: The Shell Petroleum Co., 1948. Pp. 82 + xviii.

The primary object of this book is to record the nature and extent of the Shell Group contribution to the war effort in the field of aviation. It particularly records progress in the sphere of fuels.

Trinidad and Tobago. Administration Report of the Petroleum Department, 1948. Trinidad: Government Printer, 1949. Pp. 17, appendices A–F, 1 map. 60c.

Subsurface Geologic Methods. Edited by L. W. LeRoy and Harry M. Crain. Gorden, Colorado: Colorado School of Mines, 1949. Pp. 826. $6.00.

A symposium of forty-six papers on the general topic of methods applied to determining subsurface conditions. Following an introduction and then a chapter on stratigraphic, structural, and correlation considerations, the next three chapters are each a collection of papers on a specific aspect. Thus, Chapter III covers subsurface laboratory methods, Chapter IV subsurface logging methods, and Chapter V miscellaneous methods. The remaining seven chapters discuss graphic representations, maps and illustrations, geology, subsurface methods as applied in geophysics, and in mining geology, geologic techniques in civil engineering, and sources of subsurface information.

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Oilfield Exploration and Exploitation.

Geology.

1504. Approximate Method of [Refractive] Computation in Seismic Technique. A. Kislow. *Nafta*, Apr. 1948, **4**, 124–128.—The Refractive Method is simpler in field work, but more difficult in working out than the Reflective Method. It is also rather superficial and limited if used alone. A simplification of the mathematical part is suggested by the author on the assumption that the strata are of similar refractivity. For sound velocities 2300–2800 m per sec error is small. If sound velocities vary abruptly it is advisable to divide the region investigated into two or more lots within which sound vel are more uniform. Discontinuities present greater difficulty, and this method, although it gives an insight into the nature of formations, must be backed by considerable practical experience.

The working of this method is illustrated by drawings from S. F. Bolszych. Stress is laid on correct computation of sound velocity. M. S.

Drilling.

1505. Yield Value of Bentonite Suspensions. E. R. Ballantyne. *Nature*, 1949, **163**, 995.—Yield values of thixotropic aqueous suspensions of Wyoming and Queensland bentonite, measured by determining the force required to move a thin plate in its own plane through the suspension, depend to a marked extent on the material of the plate. The values for various plate materials lie in the order Al > mica > Pt. Of possible reasons for this variation, surface finish and changes in contact angle have been eliminated. It is believed that the explanation lies in the interaction of the plate with the suspension, since a Pt plate covered with $AlCl_3$ gives practically the same yield value as does an Al plate, and if the Al plate is given a -ve charge of 1 V the yield value of the suspension is decreased. H. C. E.

1506. Use of Cable Tools in Wet Holes at High Stroke Rates. J. F. Kendrick. *Oil Gas J.*, 26.5.49, **48** (3), 87.—A study of cable-tool drilling at high speeds indicates that it should be possible to drill at speeds above resonance and also to drill as effectively in wet as in dry holes.

It will be necessary to increase the drilling speed without effectively changing peak stress in the drilling cable or the basic impact of the bit.

Consequently, since little is known of high-speed cable-tool drilling, a trial-and-error method of determining the best combination of length of stroke and strokes per minute is necessary. These are best determined by dynamometer studies.

It is concluded that the subsurface stroke does not affect mixing of the cuttings provided the impact is adequate and that a short, fast stroke should be satisfactory.

By analogy with sucker-rod pumps and a consideration of the effects of pressure on viscosity and specific gravity it is concluded that drilling is independent of whether the hole is wet or dry, and that it is possible to drill satisfactorily in a wet hole.

C. G. W.

1507. Corrosive Protection for Offshore Structures. A. E. Burns, Jr. *Oil Gas J.*, 19.5.49, **48** (2), 241.—See Abstract No. 1134. C. G. W.

1508. Detection of Incipient Drill-Pipe Failures. W. C. Main. *Oil Gas J.*, 9.6.49, **48** (5), 79.—Methods of inspection of drill pipe include: (1) electric conduction tests; (2) electric magnetic induction tests; (3) magnetic field tests; (4) electric field tests; (5) thermal non-destructive tests; (6) radiation penetration tests; (7) mechanical vibration; (8) luminous energy (optical viewing); (9) pressure leak and penetrating tests; (10) mechanical caliper and gauge tests.

Of these, (8) and (10) are in wide use, and nos. (2) and (3) offer interesting possibilities. These methods are investigated in some detail. C. G. W.

1509. Characteristics of Detergent Suspended Drilling Fluids. T. M. Doscher. *Oil Gas J.*, 30.6.49, **48** (8), 75.—The properties of fluids prepared from ceramic clays,

calcium chloride, detergent oil, and water are described and summarized. The effect of varying the concentration of each constituent is evaluated and plotted graphically. C. G. W.

1510. In-Fill Drilling. D. H. Stormont. *Oil Gas J.*, 9.6.49, **48** (5), 68.—Current development activity in a northwestern Louisiana pool, particularly development of a chalk pay, is described. C. G. W.

1511. Electrodrill Recovers Cores for Secondary Recovery Projects. A. Arutunoff. *Oil Gas J.*, 26.5.49, **48** (3), 106.—The unit consists of a transportable, self-contained, electric-motor-driven drilling unit lowered and raised on a power cable. The drill unit contains a circulating pump and a bailer section into which cuttings are deposited by circulating fluid.

The bit passes through 7-in casing, cuts 6¼-in hole, and produces a 3¾-in core. The motor is 17·5 h.p., 3600 r.p.m. geared to 265 or 675 r.p.m. at the bit. The core barrel takes up to 8 ft of core. C. G. W.

1512. Freeing Stuck Drill Pipe. J. S. Talbot. *Oil Gas J.*, 19.5.49, **48** (2), 238.—Causes of stuck drill pipe may be: (1) key-seating, *i.e.*, cutting of the drill pipe into the formation in a crooked hole; (2) improper mud control causing settling of cuttings or sloughing of formation into the hole; (3) settling of cuttings in washouts or caves; (4) balled-up bits.

Oils and acids have been used to assist freeing at stuck points, and more recently mud-acid has come into use. It is emphasized that working of the pipe before chemical treatment is likely to compact the clays, etc., and render the treatment ineffective.

The method adopted is to isolate the slush pumps and then pump about 1000 gal of mud acid into the drill pipe preceded by 10–20 brl of water. Water is pumped behind the acid. When about 200 gal of mud acid have passed through the bit, the pipe is worked and torque applied. After freeing, the pipe is worked vertically as far as possible to clear any tight spots. Water load and mud acid is removed through the drill pipe by keeping the annulus full of mud. All water and acid must be removed from the mud-circulation system before resuming operations. References are appended. C. G. W.

1513. Gamma Ray Radiography of Drag Type Drill Bit Blades. J. M. Williams. *Oil Gas J.*, 12.5.49, **48** (1), 80.—To examine Drag-type bits for defects after welding, gamma-ray radiography may be used.

Radium capsules are used in conjunction with X-ray films, and the exposure adapted to the needs of the job by varying the film or distance between film and capsule.

Details of radiographing are given. C. G. W.

1514. Control of Heaving Shale. W. V. Vietti. *Oil Gas J.*, 5.5.49, **47** (53), 75.—Sodium silicate mud is, at present, the only drilling fluid which can be used to drill heaving shale. Three examples of wells drilled through heaving shale with silicate mud are given.

When heaving shale is expected, it is good practice to case before switching muds. The treatment and preparation of silicate muds is also described. C. G. W.

1515. Mud Control and Design in Modern Drilling Practice. V. Horner and W. B. Kimbrell. *Oil Gas J.*, 12.5.49, **48** (1), 83.—The selection and control of muds for drilling is a major consideration in modern drilling technique. Control of weight, viscosity, and gelation, and filtration properties are dealt with at very great length. C. G. W.

1516. New Techniques for Increased Demand. L. S. McCaslin. *Oil Gas J.*, 19.5.49, **48** (2), 186.—Developments in drilling and production equipment and techniques in the Gulf Coast Area are reviewed. The increase in offshore drilling, use of automatic controls, and directional drilling are particularly mentioned. C. G. W.

1517. Offshore Drilling. L. S. McCaslin. *Oil Gas J.*, 19.5.49, **48** (2), 212.—In spite of litigation, high costs, and hazards, there are now twenty-seven operations under way in the Gulf of Mexico.

Methods used have been: the platform, platform–barge combination, submerged barges, and a floating pile structure which can be submerged and refloated after completion. C. G. W.

1518. Power Requirements for Rotary Drilling. R. W. Craig. *Oil Gas J.*, 16.6.49, **48** (6), 97.—Power requirements to the extent of 100 h.p. per 1000 ft of depth have been accepted in the past. Typical power requirements are analyzed and evaluated, and it is concluded that for large diameter holes more power than this is necessary. C. G. W.

1519. Strength of Rocks Forming the Walls of Oil Wells. A. Salustowicz. *Nafta*, May 1948, **4**, 164–168; June 1948, **4**, 207–211.—Author carries out a mathematical analysis of pressures prevailing on the walls of oil-wells and estimates them as equal

$$p_{\text{vertical}} = -\gamma h$$

where γ = sp. gr. of rock

$$p_{\text{horiz., parallel to wall}} = 0$$

$$p_{\text{horiz., normal to wall}} = 2\,\frac{p_{\text{vert.}}}{m-1}$$

where m = Peissoin's ratio m varies from 11 to 2 for sandstone. Drilling mud reduces $p_{\text{horiz. normal}}$ by $p_\theta = -\delta h$, where δ = sp. gr. of mud. For a circular hole these lead to evaluation of radial, tangential, and vertical pressures σ_r, σ_t, σ_z.

If tectonic forces are of great importance

$$p_{\text{horiz., normal}} = 2p_{\text{vert.}} \times n$$

where n has values between $-0{\cdot}5$ and 2.

From this consideration σ_r, σ_t, and σ_z are estimated in various circumstances. From these values strain with or without the use of mud may be calc. The resistance of the rock is then worked out on the basis of Prof. Burzynski's hypothesis of immutability as a function of t, s, and z

where $t = +\frac{1}{2}\sqrt{(\sigma_t - \sigma_r)^2 + (\sigma_r - \sigma_z)^2 - (\sigma_z - \sigma_t)^2}$

$s = \frac{1}{2}(\sigma_t + \sigma_r + \sigma_z)$

z = ratio of compressive and tensional critical forces $= \frac{k_z}{k_r} \simeq 9$.

Due to the existence of many variables the results are tabulated and plotted. It should be remembered that where tectonic horizontal pressures are present, drilling mud, instead of giving support to the well walls, merely lowers their strength. This occurs on the convex side of folds of granular formations. M. S.

1520. 126 Wells Below 12,000 ft in 1948. E. M. Abbot. *Oil Gas J.*, 19.5.49, **48** (2), 203.—126 wells were drilled below 12,000 ft in the Texas–Louisiana coastal area in 1948. Eighteen fields have found production in the Gulf Coast below this depth. It is predicted that the economic limit of deep drilling in the Gulf Coast will soon be reached.

Some statistics of deep wells in Gulf Coast areas are given. C. G. W.

1521. Wire Lines for Cable Tool Drilling. R. B. Anderson. *Oil Gas J.*, 26.5.49, **48** (3), 102.—Cable-tool lines must be selected with some consideration for their resistance to bending stresses, breakage on bull-wheels, and abrasion resistance. Safety factors of six or seven are desirable, except for sand-line service, where factors of five or six may be adequate.

Drilling below 6000 ft causes trouble with most lines, and gradually tapered lines are the only type which give satisfactory service. C. G. W.

1522. Operating Data on World's Deepest Well. R. F. Carlson. *Oil Gas J.*, 23.6.49, **48** (7), 117.—The drilling programme, including casing, cementing, and mud data, for this 20,400 ft well is described. C. G. W.

1523. Patents. British Oilfield Equipment Co. and N. Matheson. B.P. 614,591 of 31.12.48. Wells.

L. C. Moore & Co. Inc. B.P. 614,606 of 31.12.48. Pipe rack for oil well drilling operations.

Byron Jackson Co. B.P. 615,015 of 12.1.49. Devices for actuating well pipe slips.

L. C. Moore & Co. Inc. B.P. 617,107 of 16.2.49. Masts or derricks for oil wells.

Byron Jackson Co. B.P. 617,817 of 23.2.49. Gun perforators particularly for perforated well casings.

J. F. Kendrick. B.P. 618,001 of 2.3.49. Drilling motion indicator for a cable tool drill. G. R. N.

Production.

1524. Closer Well Spacing and In-fill Drilling. C. W. Tomlinson. *Oil Gas J.*, 16.6.49, **48** (6), 90.—It is postulated that with wide spacing the natural energy of a reservoir is exhausted before oil is brought to a well, thus leaving large volumes of irrecoverable oil. Greater oil production is obtained with closer well spacing, and, when secondary recovery is adopted, greater recovery is obtained at less cost. C. G. W.

1525. Devices for Starting and Stopping Well Bottom Pumps. S. Krimmer. *Nafta*, May 1948, **4**, 171–174. (From the work of (Polish) Petroleum Institute.)—Results of a competition for such devices and diagrams of the five best entries are given. In awarding prizes the committee paid particular attention to safety requirements, reliability in all weathers, simplicity, and low cost. M. S.

1526. Drilling and Production (in Poland) in March 1948. H. Górka. *Statystyka Naftowa Polski*, Mar. 1948, **4**, 179–183. [Supplement to *Nafta*, May 1948, **4**.]—Figures are given for quantities of crude pumped, gas produced, unrefined gasoline obtained, and drilling operations in progress during March 1948. A graph is plotted showing crude and natural gas production for 1947–48, together with origin. Data for 1948 covers the first quarter only. Some outstanding figures are also given. The monthly figures are: crude, 11,312,438 kg; natural gas, 16,879,000 m^3; gasoline fraction, 833,422 kg; drilling 5844 m in eighty-three wells.

Four pages of comprehensive tables are given. M. S.

1527. The Exploitation of Petroleum by Mining. Anon. *De Ingenieur*, 19.8.49, No. 33, M37–40.—The article mentions two sites where oil mining is in progress, Pechelbronn in Alsace and Wietze, Province Hanover, W. Germany.

The primary working Pechelbronn is the subject of this issue. It is mentioned that the presence of oil was known in Pechelbronn during the Middle Ages and was first extracted in 1735.

A short summary of its history is given, pointing out the changing control of the area, viz., from 1889 by Alsace, from 1905 by Germany, and from 1919 by France.

As the oil-sand layers are widely dispersed, the original method of boring proved both costly and slow. To combat this the mining method was introduced, a sinking of main shafts and the running of galleries in the harder layers from which, at all angles, short borings into the oil-sand layers could be effected.

The oil is obtained at present between 150 and 920 m, but it is planned to work even deeper.

The mining conditions are reported as good and notably free from dust.

A mine working is described and illustrated in detail. A. H. B.

1528. Five Spot Fallacy in Secondary Recovery. H. W. Fuellhart. *Oil Gas J.*, 5.5.49, **47** (53), 65.—From consideration of sand characteristic curves it is concluded that a five-spot pattern is not necessarily the best pattern for injection.

Areas and focal points of low permeability are the best locations for injection wells. C. G. W.

1529. Petroleum-Engineering Study of Atlanta Oil Field, Columbia County, Ark. C. H. Riggs. *U.S. Bur. Min. Rept. Invest.* 4455, 1949, pp. 55.—Reviews reservoir conditions and pressure-production history of the Smackover limestone fields in southern Arkansas. The principal reservoir in the Atlanta field is an oolitic limestone

near the top of the Smackover formation of Jurassic age. Structure is a narrow east-west anticline with two main east and west domes and minor cross faults. Productive area includes 4172 acres, and the oil-producing reservoir about 53,171 acre-ft. Porosity varies, and total voids in the oil reservoir calculated to be 8042 acre-ft. Weighted average porosity of the oil reservoir was 15·125%.

Gas-producing reservoir rock in the west field included 18,638 acre-ft, total voids being 1630 acre-ft, and average porosity 15·81%. G. S.

1530. Reservoir Engineering in Alberta. J. E. Baugh. *Oil Gas J.*, 23.6.49, **48** (7), 133.—Geological and reservoir data of the productive zones of the Canadian Leduc field are given in detail. C. G. W.

1531. Water Collector. Horizontal-Well System. L. Ranney. *Oil Gas J.*, 5.5.49, **47** (53), 60.—The water collector is a reinforced concrete shaft about 16 ft in dia sunk into the aquifer to be tapped. From the bottom of this shaft, about ten horizontal perforated pipes 8 in in dia are projected radially to 200 or 300 ft. On the forward end of each pipe is a digging head which selectively removes silt and fine material from the path of the pipe and the surrounding earth.

A gate valve controlled from the surface is situated at the end of each pipe. High-capacity deep-well pumps with intakes just above the screen pipes bring the water from the draft to the surface. The buried sand beds form a sand filter which removes all suspended matter and much saline and contaminating matter. The temp of the water is constant the year round. Installations may have capacities up to 30 million gal daily. Owing to the low fluid velocities there is no sanding-up or encrustation of the screws. Repair and upkeep costs are nil.

Water collectors can be used to recharge the aquifer during wet seasons.

C. G. W.

Transport and Storage.

1532. The California Co. Lays First Offshore Pipe-Line. L. S. McCaslin. *Oil Gas J.*, 11.8.49, **48** (14), 70.—The laying of the 3-mile length of 4-in pipeline in the Gulf of Mexico to the California Co's Bay Marchand field is described.

The offshore part of the line was first welded together in three sections, coated and wrapped, and floated in by means of 55-gal drum buoys tied with rope at 45-ft intervals.

A daily production of 7000 brl can now be handled with flowing pressures ranging from 250 to 1000 p.s.i. G. A. C.

1533. Control of Product Stock Losses in Storage and Loading. Anon. *Oil Gas J.*, 28.7.49, **48** (12), 272.—Accurate information on the overall stock loss plus knowledge of the individual loss sources and means for reducing or eliminating such losses is the foundation upon which a stock-loss-reduction programme can be built. Charts are shown by which the Esso Standard Oil Co. estimate breathing and filling losses from fixed-roof tanks. They relate the major variables which influence the rate of evaporation from this type of tank. The data required for use of the correlations are obtained from plant and laboratory records, with the exception of paint and condition factors. Good, fair, and poor tank-condition factors are given for six described tanks, and paint factors for J.M. insulation and six colours are tabulated. The application of the charts is described, and an example calculation—transport loss—is shown. Charts are given showing evaporation losses in floating-roof tanks, single and double Wiggins seals, in relation to wind velocity and for filling loss in loading tank cars and trucks by the splash method. The application of the charts is discussed and illustrated by operations at a Marine terminal which receives products by tanker and distributes them, by barge, tank cars, and trucks. This covers data as to suppliers' accuracy. control of transport losses, accuracy of tanker calibrations, and procedures where differences are found, and control and methods of measuring tank-car and truck filling. Control procedures have been applied, under test conditions, to the operations of two terminals within the Esso marketing interests and are described. A comparison of motor gasoline losses at the two terminals is shown and fully discussed.

W. H. C.

1534. Cost-imating. Pipes and Tubing. W. L. Nelson. *Oil Gas J.*, 4.8.49, **48** (13), 65.—No. 42 in the series gives approximate cost indices for copper-base tubes, lead pipe, black pipe, boiler tubes, and refinery labour for years 1926–49.

Tables list approximate cost of standard extra-heavy and seamless steel pipe and tubing. G. A. C.

1535. Designing Industrial Steam Transmission Piping—II. T. G. Hicks. *Mech. World*, 26.8.49, **126** (3267), 235.—The paper considers various methods of absorbing thermal expansion in long steam-transmission lines.

The four methods are: (1) use of expansion bends; (2) use of double-offset expansion U bends; (3) use of slip joints; (4) use of expansion bends composed of welding elbows. The best type is that which will absorb the thermal expansion at minimum first, operating, and maintenance costs, and has the longest life. Each method is illustrated, described, and discussed individually. A. S.

1536. Mechanical Vibration of Piping Induced by Gas-Pressure Pulsations. R. C. Baird and I. C. Bechtold. *Oil Gas J.*, 28.7.49, **48** (12), 292.—Practically all compressors and their associated piping will show evidence of certain dynamic forces which are the result of the reciprocating action of the cylinders. One of the most important of these is the presence of pulsative flow of the gas phase of the system. The fundamentals underlying the production of pulsation in such systems are described. A system designed and built from the singular viewpoint of static forces may show a predilection to operate dangerously stress-wise when subjected to dynamic forces, and may lend itself to such a degree of vibrational indulgence that at certain points in its structure the instantaneous stresses present may and often do produce fractures. The usual sources of energy of vibration of pipes and associated structures are described, and three ways by which pressure pulses can be produced and superimposed upon the mean static pressure of the gas flow system are described. An analysis is made of mechanical vibration resulting from pressure pulsations. It reveals the manner in which pulsation energy results in mechanical vibration. Some of the pulsation energy is converted into periodic physical force because of the interaction between the gas and the pipe through which it is flowing. These periodic physical forces, which usually have a complex wave, will often contain component frequencies of the pipe or associated structures. The force stimulation necessary for mechanical vibration is thereby achieved. W. H. C.

1537. New Pipe-laying Method Expedites Marsh and River-Crossing Operations. L. S. McCaslin. *Oil Gas J.*, 21.7.49, **48** (11), 81.—The Sherrod Punch-Pull method of laying pipelines in marshy terrain involves use of a punch, spud barge, and laying barge.

Punch consists of two steel pontoons to which are attached a large steel cutting blade and a torpedo or punch.

The pontoons are left empty and ride the surface in marsh operations, but in water crossings buoyancy is eliminated by flooding pontoons with water so that they ride the stream bed. The cutting edge prepares way for the punch at desired depth below surface of marsh or stream bed, the punch making a hole for the pipe being laid, the pipe being tied behind punch.

It is estimated that 20,000 ft of 6-in Schedule 160 wrapped pipe can be pulled. G. A. C.

1538. New River Tow is High Speed Unit. Anon. *World Petrol.*, 1949, **20** (7), 34–35.—A detailed description is given of a diesel-powered towboat capable of a still-water speed of 12 m.p.h. with a 62,000-brl load. Three barges are hauled, the complete tow having the profile of one barge 870 ft long. Radar is installed. E. B.

1539. Rock Shields Prove Economical in Protecting Pipe-Line Coating. P. Reed. *Oil Gas J.*, 21.7.49, **48** (11), 84.—Kapco rock shields are wrapped and bound to the pipe preparatory to lowering in the ditch, instead of padding to protect pipe coating.

A pliable, hard-mastic board is "packaged" with special wood-fibre strapping material, the band being applied with a hand-operated machine by which four men apply two Kapco rock-shield sheets in 1¼ min. G. A. C.

1540. 32,300 Miles of Pipe Line Planned; 3350 Miles Completed This Year. P. Reed *Oil Gas J.*, 28.7.49, **48** (12), 226.—Eleven tables show the U.S.A. and foreign pipelines for crude oil, natural gas, and products: (*a*) planned and under way and (*b*) already completed in 1949. The length, diameter, company, and location, and where possible the contractor and expected date of completion, are shown. The figures given for the mileage of lines planned are:—

U.S.A.: For crude oil, 4800; products, 1600; natural gas, 16,900.
Foreign: For crude oil, 4600; products, 1400; natural gas, 4300.

W. H. C.

1541. Patent. Shell Mex and B.P., Ltd., and W. E. Greasley. B.P. 615,236 of 19.1.49. Means for delivering liquid in bulk from tanks of road vehicles. G. R. N.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1542. Centrifugal Machines in Modern Processes. Anon. *Mechanical World*, 5.8.49, **126** (3264), 160.—Classification of centrifuges can be carried out in two ways: (i) according to duties they perform, (ii) according to mode of operation. First of these include: (*a*) liquid–liquid separation; (*b*) liquid–liquid–solid separation; (*c*) liquid–solid separation. When classified according to their mode of operation, centrifuges include the following types: (1) Tubular, (*a*) single-pass, (*b*) multi-pass; (2) Disc squat bowl, (*a*) standard type, (*b*) nozzle-discharge type (*c*) valve-discharge type; (3) Decanters, (*a*) vertical bulk type, (*b*) automatic batch type, (*c*) continuous-sludge-discharge horizontal type; (4) Perforated baskets, (*a*) vertical bulb, (*b*) automatic-bath type, (*c*) conical-rotor type. It is claimed that over 500 applications of centrifuging are now in use, and these are encountered in engineering, petroleum refining, sugar refining, soap manufacture, food manufacture, paint and varnish manufacture, textiles, and many chemical and allied processes. A few of these applications are briefly reviewed. A. S.

1543. Cost-imating Refrigeration Auxiliaries. W. L. Nelson. *Oil Gas J.*, 14.7.49, **48** (10), 111.—No. 89 of the series gives tables showing the 1946 costs of: (1) insulation of walls, ceilings, and floors, in/sq. ft. for block thickness; 4, 6, 8, and 10 in; and for three grades of pipe insulation for pipes $\frac{1}{4}$, 1, $1\frac{1}{4}$, 2, 3, 4, 6, 8, and 10 in dia (/ft); (2) cold-storage rooms, two capacities and three grades; (3) water-coolers and refrigeration condensers (eight areas). Notes and other pertinent data are included.

W. H. C.

1544. Cost-imating Structural Steel-pipe Stills. W. L. Nelson. *Oil Gas J.*, 28.7.49, **48** (13), 339.—The approximate weight of pipe-still frames can be obtained from the chart presented, which shows the weights of different types of construction. Tables are given showing: (1) the approximate weight of buckstays (I-beam) for supporting condenser boxes; (2) the approximate cost (1946) of 7-ft fencing, composed of lines of three-barbed wire, and posts $1\frac{1}{2}$ inch top, in/ft. Costs are also given for extra terminal and corner posts and for gates, 2 in frame. A list is given of other structural-steel estimates discussed earlier in this series. W. H. C.

1545. Design of Finned Tube Exchangers and Condensers. L. Katz and R. B. Williams. *Oil Gas J.*, 29.7.49, **48** (12), 245.—An illustration is given of an integral spiral-finned tube with plain ends slightly larger than the diameter over the fins. The operation by which spiral fins are made from a thick-walled tube allows the leaving of a plain section at intervals for spacer plates. The dimensions of low-finned tubes having sixteen fins per in are tabulated for $\frac{3}{4}$–$\frac{1}{2}$ in tubes. Tubes having about $2\frac{1}{2}$ to 3 times the outside area of plain tubes give the greatest increase in heat transfer when the outside coefficient is relatively low. Methods for computing the condensing coefficients of finned tubes are recorded. Design methods, including the use of fin efficiencies, are given for an acetone condenser, a propane condenser, and an oil-heat exchanger, by example calculations. W. H. C.

1546. Fluid Flow—Chemical Engineering Report. *Chem. Engng*, 1949, **56** (5), 91–138.—A review of recent progress is followed by brief articles under the following heads. Flow computation by vel head; flow of gas–liq mixtures; flow of non-Newtonian suspensions; gas–solids fluidizing for transport; flow on fluidized reaction systems; fluid flow through packed beds; pressure drop across tube-banks; flow of low-press gases; compressibility in gas-flow problems; progress in pumping liquids; high-capacity compression; higher process press; vacuum processing equipment; and ejectors. R. G. T.

1547. Loss Control in Petroleum Refineries. Anon. *Oil Gas J.*, 28.8.49, **48** (12), 261.—The loss-control programme, practised by the Esso Standard Oil Co. is described. The three main phases cover: (1) determination of the amount of total loss; (2) isolation of all loss sources and development of means of reducing or eliminating the losses; (3) application of a system to control them within reasonable limits. Total loss covers transportation, terminaling, crude-oil storage and manufacture. The components of each of these divisions are discussed. Isolation and evaluation of individual loss sources, comprises the total plant losses, and serves a dual purpose—the total of individual losses is a check on the reasonableness of calculated loss; and is a measure of the progress of investigations of individual loss sources. The application of the control system is outlined. Typical loss sources in a refinery are enumerated.

Seven graphs show data relative to the recovery from various processing units, *i.e.*, relationship between actual and apparent water content; contraction on blending; reduction on oxidation of asphalts. Calculation procedure in manufacturing operations is widely discussed. All liquid products (C_4 and higher) are recorded by volume, gases (C_3 and lighter) and solid products by weight. The calculation of manufacturing losses by the "anticipated recovery" procedure is recorded. It is calculated for a total divisor made up as follows: crude oil processed (H_2O free), brl 80; unfinished stocks processed (H_2O free), brl 20. The corrections to be applied for each of the ten processes or components in the calculation, derived from the appropriate graphs mentioned, are explained individually. W. H. C.

1548. Maintenance Program . . . in a Major Refinery. J. A. Oslin. *Oil Gas J.*, 14.8.49, **48** (10), 70.—A description is given of the maintenance programme of the Magnolia Petroleum Co.'s, 150,000-b.d. refinery at Beaumont, Texas. The programme, inaugurated in 1940, has since then undergone constant revision and expansion. It covers: preventive, corrective, routine, emergency, and special maintenance. Closer control of maintenance expense has resulted from the planning and scheduling procedure set up on a plant-wise basis, all sections co-operating. The procedures of the various sections are described, and cost control and the issue of work orders are outlined. A special section was set up for the evaluation of labour-saving devices, and specialists advise on improvements in maintenance facilities, especially as to corrosion-resistant alloys, etc. Equipment materials, plant lay-out improvements, and relocation and elevation of refinery lines are described. Inspection methods are outlined, use of the Penetron and Audigage has saved much time.

Turnarounds are lengthily discussed; they are scheduled a year in advance. By planned release of units, 15–20% in man-hours are saved, and many stream-days are gained. One of the improved maintenance methods described is that of coke burning instead of mechanical removal. The technique and set-up are described. Tank bottoms, spent clays, and catalysts, and other solids and liquids are removed from vessels, etc., by a vacuum cleaning unit. Chemical cleaning of fractionating columns, etc., and other methods employed are described. Tools and materials are handled by means of mobile lorries, cranes, diesel locomotives, and other vehicles. Many illustrations are shown. W. H. C.

1549. More than 150 Active Refinery Building Projects Now Under Way. R. B. Tuttle. *Oil Gas J.*, 28.7.49, **48** (12), 208.—Tables are given of active refinery-building projects, refinery-expansion projects completed in first half of 1949, natural-gas processing-plant projects, and natural-gas processing-plant expansion projects completed in first half of 1949. The company, location, type of project, capacity rating, status, completion schedule, and contractor's name being shown.

Included in the list are nine new petrochemical plant programmes under construction. W. H. C.

1550. Native Fish Help Ashland Refinery Water Disposal System. J. A. Wallen. *World Petrol.*, 1949, **20** (7), 40–41.—Water from two refineries on the Big Sandy River is cleaned and returned to the river. Caged fish (native cat-fish and sun-fish) are used to test the effluent. This is also tested in the laboratories for chemical contamination and as potential drinking water. E. B.

1551. Statistical Procedures Applied to a Pilot Unit—[A Reproducibility Study]. R. F. Huhndorff. *Industr. Engng Chem.*, 1949, **41** (6), 1300.—Modern statistical methods have been applied to the data obtained from pilot-unit operation during a reproducibility study of a fluidized fixed-bed cat-cracking pilot unit. No homogeneity of variances was shown in a test. Excessive variation of the average yield data was indicated—a time element was believed to be the cause. R. G. T.

1552. Temperature Gradients and Eddy Diffusivities in Turbulent Fluid Flows. R. J. McCarter, L. F. Stutzman, and H. A., Koch, Jr. *Industr. Engng Chem.*, 1949, **4** (6), 1290–1295.—Turbulent flow theory and its relation to diffusivity problems is discussed. Elementary diffusivity equations are derived and used to correlate data. Two experimental procedures are described for determination of the dimensional value of eddy diffusivities in turbulent gas flow by studies of thermal energy transfer. A vertical 8-in-dia steel duct was used with flow velocity of 2–7 f.p.s. The factors influencing diffusion and mixing are qualitatively deduced from preliminary results. A simple and useful method for investigation of turbulent flow and transfer problems is claimed. R. G. T.

Distillation.

1553. Revised Depropanizer Instrumentation Improves Plant Operation. H. B. Breedlove. *Oil Gas J.*, 25.8.49, **48** (16), 132.—As a result of frequent upsets on the depropanizer unit at the Baton Rouge refinery of Esso Standard Oil Co., instrumentation has been revised with good results. Changes to feed accumulator pressure and feed preheater temp controls and to lower bottoms temp and flow controls, with adjustment of tower pressure controls have resulted in improved stability of the tower and instrument correction of upsets without manual adjustment by the operator. Experience has shown that steam—condensate—removal control systems are not suited for installations where abrupt changes in heat demand are experienced. G. A. C.

1554. Esso Standard Places Giant Reduced Crude Unit on Stream. G. Weber. *Oil Gas J.*, 4.8.49, **48** (13), 63.—Initial runs on the 49,000 brl capacity of reduced crude per stream day vacuum pipe still recently completed by Esso Standard Oil Co., are being conducted at Bayway refining New Jersey. G. A. C.

1555. Estimation of Distillation Columns. Anon. *De Ingenieur*, 5.8.49 (31), CL. 13.—A short article on the above subject giving method and calculations quoting: "Fractional distillation—the selection of test mixtures for estimating the efficiency of fractionating columns," by E. A. Coulson and E. F. G. Herington (*Trans. Faraday Soc.*, 1948, **44**, 629–636) and "Thermodynamics of non-electrolytic solutions," by O. Reduch and A. T. Kister (*Industr. Engng Chem.*, 1948, **40**, 341–348). A. H. B.

1556. Patents. Distillation Products Inc. B.P. 613,468 of 8.12.48. High vacuum condensation or diffusion pumps.

Anglo-Iranian Oil Co. (R. A. King). B.P. 614,309 of 31.12.48. Fractionation applied to petroleum and other hydrocarbon feed stocks.

Anglo-Iranian Oil Co. and M. E. Kelly. B.P. 614,388 of 31.12.48. Fractional distillation. G. R. N.

Solvent Extraction and Dewaxing.

1557. The Kellogg-Solexol Process. Anon. *De Ingenieur*, 5.8.49 (31), CL. 13–14.—The above extraction process is described and illustrated by a diagram showing propane

extraction. Quoted are: (*Trans. Faraday Soc.*, 1948, **44**, 636–644) and "The Solexol Process," by H. J. Passino (*Industr. Engng Chem.*, 1949, **41** (2), 280–287).

A. H. B.

1558. Solvent Extraction as a Unit Process. J. C. Wood-Mallock. *Industr. Chem.*, 1949, **25**, 343–347.—Required properties of an extractive solvent for the partition of hydrocarbons are discussed. V.G.C. is an additive property suitable for measuring the progress of extraction, and is used as a means of evaluating the efficiency of any solvent with respect to a standard distillate. The terms "half raffinate" and "ultimate raffinate" are explained, and the Terres method for determining the characteristics of the ultimate raffinate by plotting V.G.C. of extract against V.G.C. of raffinate for different solvents is described. Triangular diagrams are applied to practical problems such as the effect of different volumes of liquid SO_2 on quality and yields of raffinates and extracts, and formation of pseudo-raffinates and more aromatic extracts from extract solutions in SO_2. Other topics discussed include selectivity with special reference to the preferential extraction of low-mol.-wt. compounds, extraction systems, and the use of mixed and dual solvents. E. B.

Cracking.

1559. Colorado's First Catalytic Cracker. J. E. Fenex, A. W. Hoge, and L. Friedman. *Oil Gas J.*, 4.8.49, **48** (13), 45.—The small-scale moving-bed catalytic cracking unit of the Continental Oil Co., erected at Denver, is described.

An unusual processing feature is the recycle ratio of the reactor, which is designed to operate at a recycle ratio of 1 : 1 on a fresh reactor charge of 3300 b.d.

The plant operations are tightly integrated, charge to each unit being received directly from the preceding section without any intermediate storage, and except for some gas-oil storage for thermal unit charge, no intermediate surge capacity has been provided. The T.C.C. unit uses Filtrol clay catalyst.

Test run performance on a fifteen-day demonstration exceeded guarantee.

Tables give crude evaluation, test-run yield summary and operating conditions, analyses, and total catalytic gasoline production. G. A. C.

1560. Continuous Contact Coking Process. A. H. Schutte and W. C. Offutt. *Oil Gas J.*, 14.7.49, **48** (10), 90.—The present situation regarding increasing demands for distillate fuels and a lessening market even for specification fuel oil from blended residual oil is discussed, and it is shown that coking fulfils the refiner's needs. The older coking methods outlined are expensive, but the continuous-contact coking process provides an economical solution for the refiner. Development of this contact process began five years ago, and pilot-plant operations on various reduced crudes are recorded, and the results are described. In continuous-contact coking heavy residuum is preheated to 750–850° F, and is passed to the top of the reactor, where it meets a relatively large flow of hot circulating coke (¼–½-in lumps). The residence time in the reactor is from 15 to 40 min. The coke stream passes out from the bottom via a sealing chamber to the coke-reheating chamber, from which it is passed to the oil-feed contact point. Circulation can be by conventional elevators or by a vapour-lift system.

Vapours from the reactor are quenched by a heavier recycle stream. The issuing vapours consist of the cracked components from the heavier fractions of the charge and the heavy virgin-oil vapours distilled under conditions of low pressure and high temperature at the oil-charge contact zone. The products having been subjected to a minimum of cracking and degradation are suitable for subsequent catalytic, or thermal, cracking. The coke produced is described; it is of exceptional quality. The net production of coke is withdrawn periodically from the heating vessel. Product quality and yields are discussed, and are shown in seven tables and compared with delayed-coking-operation results. Commercial-plant design is outlined. The process produces less gas, less gasoline, 9–13% more and better quality gas oil, and less coke than delayed coking does. Investment cost is about 60–80% of delayed coking cost, and process costs are low. There are no coke removal expenses. W. H. C.

1561. Contribution to the Theoretical and Experimental Study of Fluid Catalyst Systems. T. Reis. *Bull. Assoc. franç. Tech. Pétrole*, 1949, (76), 3–44.—The scope of fluidized

technique, including applications outside the pet industry, is outlined, and a definition of the terms used given. The theoretical views put forward by previous workers are summarized, the formulæ being depicted graphically wherever possible. A new laboratory method for determining the behaviour of suspended particles is described. A glass model cat cracker unit (U.O.P.) is used, and a light ray after passing through a glass tube in which cat is being lifted by gas flow impinges on a photo-cell whose output is fed to a cathode-ray oscillograph. The photo-cell current is modulated by the interruptions to the light beam caused by the cat particles, whilst its intensity depends on attenuation of the light by diffusion. Current intensity is proportional to particle concn, whilst modulation frequency indicates rate of flow, thus enabling total cat flow to be indicated and, if required, automatically controlled. Details of the laboratory apparatus and circuit used are given. New theoretical aspects of the fluid flow of solid particles are developed, including the calculation of the "slip factor" (*i.e.*, difference between velocity of particle and of gas). Calculations of particle trajectories and also of the distance a particle has to travel to attain gas velocity are made. The possible applications of statistical mechanics to fluid cat are outlined and further experimental work (use of Tyndall effect and of radioactive tracers) suggested.

V. B.

Alkylation.

1562. Operational Flexibility Gained in Recent Additions to Wood River Refinery. R. B. Tuttle. *Oil Gas J.*, 11.8.49, **48** (14), 74.—Data obtained on full-capacity test runs extending over long periods on the cycloversion plant of the Wood River Oil and Refining Co. at Hartford, Ill., are presented.

Operation one yielded a gasoline with an octane rating improved by about 18 numbers; operation two gave a 92 research octane gasoline, operations 3 and 4 produced 88 research octane gasoline, and 89 research gasoline respectively (all with 3 ml T.E.L/gal). G. A. C.

1563. Patents. A. H. Stevens (Phillips Petroleum Co.). B.P. 613,926 of 22.12.48. Alkylation process and products.

Compagnie Française de Raffinage. B.P. 615,566 of 19.1.49. Alkylation of aromatic hydrocarbons.

U.O.P. Co. B.P. 615,624 of 19.1.49. Alkylation of aromatic hydrocarbons.

G. R. N.

Special Processes.

1564. Producing Aliphatic Solvents. J. V. Hightower. *Chem. Engng*, 1949, **56** (5), 139–141.—An account is given of Humble Oil Co.'s process for aliphatic solvents of narrow boiling range. The applications of such solvents are briefly discussed—primarily in the protective-coating industry. Detailed account is given of the method of production of heptane, hexane, and octane solvents. Fractionation, acid treatment, and caustic washing are described. Composition of the various products concludes the article. R. G. T.

1565. Carbon Blacks. J. Parisot. *Chim. et Ind.*, 1949, **61**, 564–570; **62**, 35–41.—A review. Theories of carbon-black formation are discussed, and the following principal manufacturing processes for the various types of blacks are described: incomplete combustion (solid, liquid, and gaseous hydrocarbons) to yield flame and furnace blacks; flame impingement, using solid and liquid hydrocarbons to yield lamp blacks and gaseous hydrocarbons to yield gas and channel blacks; thermal decomposition (including acetylene blacks); decomposition of CO. The principal physical properties (including intermolecular dimensions) of the various blacks are tabulated and test methods outlined. Six French factories are at present supplying the domestic requirements of flame blacks (3000 tons/yr), but gas blacks for the rubber industry have to be imported (50,000 tons/yr.). Forty-nine references. V. B.

1566. What to Look For in CO Conversion Catalysts. D. C. Christain and P. B. Boyd, Jr. *Chem. Engng*, 1949, **56** (5), 148–150.—Catalysts for reaction $CO + H_2O = CO_2 + H_2$ vary widely in two important requirements—activity and durability. The way the

cat is manufactured is as influential as its composition. Present-day economics of the conversion are discussed. New hydrogen sources are required for the increased uses. Catalysts are described and results of lab tests on them are given. Relative efficiencies vary widely up to *ca* 95%. Modern application and operational factors are discussed. R. G. T.

1567. Researches on Iron Catalysts for the Hydrogenation of CO. (Reaction Mechanism of the Fischer–Tropsch Synthesis, Pt. II.) H. Kölbel, P. Ackermann, R. Juza, and H. Tentschert, *Erdöl u. Kohle*, 1949, **2**, 278–285.—Fe cat was studied both in the new (α-Fe_2O_3) and formed (240° C, 2/1 CO/H_2, normal pressure, 48 hr) condition. Detailed tests (X-ray, thermomagnetic) were carried out on the formed cat. In cat containing K and Cu presence of these metals as ferrite could not be detected. Formed cat was principally Fe_3O_4, but always containing Fe carbide (10–15%) of average formula $Fe_{2.6}C$. The carbide was detected by chemical analysis and was not evident from X-ray examination. No elementary Fe and very little Fe_2O_3 was found. Cu could be detected by X-rays only if present in excess of 5%. The nature of the iron carbide present is discussed, and it is suggested that the importance originally ascribed to this component of the cat cannot be upheld. (Cf. Abstract No. 808.) V. B.

1568. Attrition Characteristics of Fluid Cracking Cats (Laboratory Studies). W. L. Forsyth, Jr., and W. R. Hertwig. *Industr. Engng Chem.*, 1949, **41** (6), 1200–1206. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—A laboratory attrition test is used to obtain data on attrition characteristics which have important effect on operation, since they directly affect cat losses. A high-vel air jet is used to cause breakdown, which is measured by screen and roller analyses. Natural SiO_2–Al_2O_3 and SiO_2–MgO ground cats are all within same attrition-resistance range. Fresh microspheroidal cats show better resistance than ground cats generally. The effect of heat-pretreatment at 1100° F varied with different cats—SiO_2–MgO cats being most increased in resistance. Attrition resistance is greatly improved during operation mainly due to mechanical action which rounds off corners and eliminates weak particles. R. G. T.

1569. Catalyst Loss Recorder for Catalytic Cracking Units. J. M. Ramser and J. W. Hickey. *Industr. Engng Chem.*, 1949, **41** (6), 1243–1247. (*Fluid–Solid Dynamics Symposium, Divn* of *Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—An instrument is described which continuously indicates and records the amount of cat carried in the flue gas of fluid cat plants. An optical device measures cat concn, and flue gas vel is measured by a flow meter. The two are coupled by an automatic mechanism which multiplies concn and flow rate, giving instantaneous cat loss per unit time. Automatic integration records the cumulative cat loss. R. G. T.

1570. Characteristics of Fluidized Particles. W. K. Lewis, E. R. Gilliland, and W. C. Bauer. *Industr. Engng Chem.*, 1949, **41** (6), 1104–1117. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—A study of the flow characteristics for both batch and continuous fluidization of fine glass spheres has been made. Correlation of the data enables prediction of the performance of such units. Glass spheres of small size give flow characteristics different from those with larger dia. R. G. T.

1571. Erosion due to Dust Particles in a Gas Stream. R. L. Stoker. *Industr. Engng Chem.*, 1949, **41** (6), 1196–1199. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Experiments are described to evaluate the basic factors of erosion which can arise in high-vel gas–solid flow systems. Targets were sandblasted at various jet vel and impingement angles with different entrained dusts. Erosion was assessed by change in weight. Plaster models can be used for predicting erosion life of more durable materials. R. G. T.

1572. Evaluation of Fluid Catalyst—(Development of Laboratory Scale Units.) R. A. Beck. *Industr. Engng Chem.*, 1949, **41** (6), 1242–1243. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Evaluation of fluidization catalysts by two types of lab scale units is described.

The mechanically stirred unit with helically finned rotor can simulate fluidization independently of the gas vel below 1 ft/sec. Great flexibility of reactant flow can be obtained. The baffled, non-stirred type is less mechanically troublesome. Small batch tests have been made on experimental cats using both types. The effectiveness of cat fluidization is maintained, with the stirred reactor even at low feed rates.
R. G. T.

1573. Fluid–Solid Air Sizer and Dryer. C. J. Wall and W. J. Ash. *Industr. Engng Chem.*, 1949, **41** (6), 1247. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Dry, dust-free rotary kiln feed has been prepared on a commercial scale from dolomite by the fluid–solid technique. Fuel saving and improved product are effected. A unit 5 ft 8 in dia, 15 ft 6 in high has capacity of 45 tons of −4-mesh feed per hour. For 2·0% water feed entering at 18° C: drying air enters at 400° C, dry, sized product leaves at 110° C and 0·02% water, moist dust-laden air leaves at 75° C. Oil-burning air heater uses 1 gal/ton feed, heating 8000 cu. ft. free air compressed to 1·2 p.s.i.g. Dust is recovered from cyclones as a dry marketable product. Possible separations of 20–100 mesh are claimed for this unit.
R. G. T.

1574. Fluid Flow through Randomly Packed Columns and Fluidized Beds. S. Ergun and A. A. Orning. *Industr. Engng Chem.*, 1949, **4** (6), 1179–1184. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—The ratio of press gradient to superficial fluid vel in packed columns is shown to be a linear function of fluid-mass flow rate. The function depends on particle specific surface, fractional void vol, and fluid visc. The constants of the equation enable prediction of the degree of bed expansion with increasing gas flow after the press gradient reaches the buoyant weight of solids per unit vol of the bed. Formal equations are developed to estimate gas flow rates corresponding to turbulent or two-phase fluidization—in which gas bubbles cause intense circulation of solids through the bed. The product of gas visc and superficial vel can be used as a standard for kinetic studies.
R. G. T.

1575. Fluidization of an Anthracite Coal. M. Leva, M. Weintruber, M. Grummer, and M. Polchik. *Industr. Engng Chem.*, 1949, **41** (6), 1206–1212. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Fluidization principles and concepts based on data with non-porous materials are briefly reviewed, with special reference to fluidization of anthracite. Fluidization problems are concerned with rate of flow, density and visc of fluid, effective particle dia, particle shape factor, and min fluid voidage. The latter two are usually required to be estimated—methods are thus given for porous and non-porous materials. The data for anthracite coal are used in an effort to demonstrate a more general approach to the solution of fluidization problems.
R. G. T.

1576. Fluidization of Granular Solids—(Fluid Mechanics and Quality.) R. D. Morse. *Industr. Engng Chem.*, 1949, **41** (6), 1117–1123. (*Fluid–Solid Dynamics Symposium. Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Correlation of data on fluid flow in fluidized solids beds aids understanding of the mechanism of fluidization. Differences observed between fluid flow in fixed and fluidized beds are explained in terms of flocculation of small particles, kinetic energy losses from turbulent motion of large mols, and the inherent instability of gas-fluidized systems. The effect of quality of fluidization (uniformity of the dispersion of fluid and particles) is emphasized.
R. G. T.

1577. Fluidization Nomenclature and Symbols. W. J. Murphy (ed). *Industr. Engng Chem.*, 1949, **41** (6), 1249. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—A discussion is described which assembled a list of recommended terms and symbols. These are generally used throughout the Symposium and are suggested as contributing to a permanent nomenclature in the field of fluidization.
R. G. T.

1578. Flow Characteristics of Solids–Gas Mixtures—in a Horizontal and Vertical Circular Conduit. L. Farbar. *Industr. Engng Chem.*, 1949, **41** (6), 1184–1191. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Isothermal flow characteristics of a mixture of Al_2O_3, SiO_2, and air have been investigated in a horizontal and vertical glass tube 17 mm inside diameter for various flow rates. Pressure drop was measured for various flow rates and solids : air ratio between 0 and 16 lb solid per lb air. The size distribution varied from $<10\ \mu$ to $>220\ \mu$, and air velocities in the solids-free section from 50 to 150 f.p.s. Several types of feeding nozzles were tested for flow stability in the system. Flow in the solids feed line, mixing nozzle, horizontal and vertical test sections, and bends, and the behaviour of a multi-effect cyclone separator are discussed. R. G. T.

1579. Characteristics of Fluid–Solid Systems. G. L. Matheson, W. A. Herbst, and P. H. Holt 2*nd*. *Industr. Engng Chem.*, 1949, **41** (6), 1099–1104. (*Fluid–Solid Dynamics Symposium, Divn. of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Results of investigation of two fundamental characteristics of fluid–solid systems—density and viscosity—are described. Effect of particle size and particle density on the max bed density and Stormer viscosity of the dense phase of fluid–solid systems has been studied. Correlations have been developed quantitatively relating the increase in the max bed density of irregular particles with increasing particle size or density. The Stormer viscosity is related to the flow behaviour of such systems. The viscosity of a narrow cut solid increases with particle size and density. The effect of fines on the viscosity of solids of wide size range is discussed. R. G. T.

1580. Gasification of Carbon by Carbon Dioxide in Fluidized Powder Bed. W. K. Lewis, E. R. Gilliland, and G. T. McBride, Jr. *Industr. Engng Chem.*, 1949, **41** (6), 1213. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—The reaction at atm pressure between CO_2 and two types of C under fluidized conditions has been investigated between 1475° and 2000° F. Correlation of the data gives an equation of the Langmuir type : CO_2 reduction rate per unit quantity of C equals

$$\frac{k_1 p_{CO_2}}{1 + k_2 p_{CO} + k_3 p_{CO_2}}$$

where the k terms are functions of temp alone. Integration of the equation is necessitated by high conversions, and graphical correlation of the integration is presented. For each C, k_1 rises rapidly with the temp, whereas k_2 and k_3 fall. At low temps the conversion fell far below the calc values near equilibrium. At high temps the conversion rates were higher than calc at low conversions. Correlations should therefore be applied only within the range of the data. R. G. T.

1581. Gas and Solid Mixing in Fluidized Beds. E. R. Gilliland and E. A. Mason. *Industr. Engng Chem.*, 1949, **41** (6), 1191–1196. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Tracer-gas and heat-flow methods have been used to study internal gas and solids flow in a fluidized bed. Small-dia reactors produced low back-mixing effects and fairly constant temp throughout. The results recommend correlation of reaction-rate studies on the basis of piston flow, neglecting mixing. Solid mixing is shown to be rapid and serves to maintain the const-temp. conditions. R. G. T.

1582. Heat Transfer Characteristics of Fluidized Beds. H. S. Mickley and C. A. Trilling. *Industr. Engng Chem.*, 1949, **41** (6), 1135–1147.—An investigation has been made of the effect of the presence of violently turbulent solids on heat-transfer conditions at surfaces in contact with the gas–solid mixture. The beds used were vertical, 1–4 in dia, 4–8 ft high. Heat transfer was through the wall confining the fluidized system or through the wall of a cylindrical heating element inserted axially into the bed. Glass spheres with dia from 0·002 to 0·02 in were used in upward flowing air at superficial vel between 0·8 and 15 f.p.s. Little transport of solid was noted, but a considerable amount of solid was recycled from an expanded upper section of the fluidized bed. Solid concn in the system ranged from zero to ½ of bulk density of glass spheres. H.T.C.'s from 10 to 120 B.Th.U/hr/sq. ft/°F were noted.

R. G. T.

1583. Mass and Momentum Transfer in Solid–Liquid System.—(Fixed and Fluidized Beds.) L. K. McCune and R. H. Wilhelm. *Industr. Engng Chem.*, 1949, **41** (6), 1124–1134. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948).—Mass transfer has been investigated between an upward stream of liquid and solid particles in consolidated and expanded fluidized beds.

The technique involved partial dissolution of spherical and flake-shaped particles of slightly soluble 2-naphthol in water. Colorimetric analysis of dye formation in the exit stream was used to measure the concn of 2-naphthol. Water-flow rate, exit concn, water temp, particle and bed characteristics, and pressure drop were measured. Correlation was thereby made of J factor, Reynolds No., friction factor, and drag coeff. Variables ranged as follows: particle size (spheres), $\frac{1}{4}$, $\frac{3}{16}$, $\frac{1}{8}$ in; (flakes), 8-, 10-, and 14–18-mesh (U.S. Standard Sieves); Reynolds No., 14–1755 in fixed beds; degree of expansion in fluidized beds, 36% voids to infinite expansion; Schmidt group, 1200–1500; bed dia, 4-in consolidated bed depth 5–24 in. Comparison is made of the correlations of mass transfer and friction in fixed and fluidized beds. The effect of fraction void and non-uniformity of flow pattern, as unifying relationships for mass transfer in fixed and fluidized bed and single particles are discussed.

R. G. T.

1584. Pressure Drop in Vertical Tubes in Transport of Solids by Gases. O. H. Hariu and M. C. Molstad. *Industr. Engng Chem.*, 1949, **41** (6), 1148–1160. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Total and static pressure drop were measured in the transport of solid particles through vertical 0·267 and 0·532 inside diameter glass tubes by an air stream. Closely-sized sand, ground and spherical silica–alumina cracking cat were used. Solids circulated at 2–54 lb/sec/sq. ft. at constant air rates of 12–40 ft/sec. Direct measurement of dispersal solids density enabled the calc of air particle vel, slip vel, and solids static pressure. Total pressure drop is equiv to the sum of the drop due to the carrier gas alone plus a solids pressure drop. An apparent solids friction drop (obtained by subtracting the solids static head from the total solids pressure drop) conformed to the Fanning equation when solids vel and dispersed solids density were used. The majority of the apparent friction was later shown to be due to particle acc in the test section. Mathematical treatment of the acc period is included. Relative vel of gas and solids is correlated with force required to overcome inertia, gravity, and solids friction.

R. G. T.

1585. Pressure Drop due to Vapour Flow through Moving Beds. J. Happell. *Industr. Engng Chem.*, 1949, **41** (6), 1161–1173. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—The flow of vapour through a moving bed of cat, in which the particles remain in a fixed position relative to each other, has been investigated. Concurrent and countercurrent flow have been studied with beds of granular, spherical, and pellet-type cats from 4 to 60 mesh. Uniform and non-uniform size grades were used. The Navier–Stokes equations have been applied to the viscous motion of fluids through uniform spheres and a correlation developed from previous work and present data. Dimensionless functions similar to normal fluid-flow groups are used to extend the correlation to the turbulent conditions. New factors due to flow through a granular medium are included in a new function of the fractional void volume.

R. G. T.

1586. Pressure Drops (Encountered in Conveying Particles of Large Diameter in Vertical Transfer Lines). D. H. Belden and L. S. Kassel. *Industr. Engng Chem.*, 1949, **41** (6), 1174–1178. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—The vertical transport of spherical cats, approx 0·04 and 0·08 in dia, has been investigated. A tentative correlation expresses total pressure drop as a static term based on particle density in the transfer line, and a friction term, involving mass-velocity, which is independent of particle density and dia. Data are compared with the data and correlation of Vogt and White, and the latter is shown to involve an apparently incorrect dependence on ratio of tube dia to particle dia. Modification seems necessary.

R. G. T.

1587. Reaction of Methane with Copper Oxide in a Fluidized Bed. W. K. Lewis, E. R. Gilliland, and W. A. Reed. *Industr. Engng Chem.*, 1949, **41** (6), 1227. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, Dec. 1948.)—Methane was reacted with CuO in a fluidized bed. Oxidation occurred with high selectivity at *ca* 1700° F. Correlation of the data was made on the following assumptions: (*a*) chemical reaction, not diffusion, was the controlling factor; (*b*) rate of reduction of CuO was fast compared to the rate-controlling process; (*c*) oxidation was complete to CO_2 and water.

Correlations showed the assumptions to be substantially correct. R. G. T.

1588. Removal of Mists and Dusts from Air by Beds of Fluidized Solids. H. P. Meissner and H. S. Mickley. *Industr. Engng Chem.*, 1949, **41** (6), 1238. (*Fluid–Solid Dynamics Symposium, Divn of Industr. Engng Chem., Amer. Chem. Soc. M.I.T.*, 1949.)—Sulphuric acid mists (2–14 μ droplet dia) were filtered at atm conditions by passage through fluidized solids in a 2-in tube. Non-porous materials showed short life (*e.g.*, SiO_2, glass beads), but porous materials, SiO_2 gel, Al_2O_3 picked up 7·5% by wt of acid. Substantially constant removal efficiency (% removal of acid mist from air) was observed over the life of the beds and was not affected by the entering concn between 20 and 120 lb acid per million cu. ft. Removal efficiency improved with increasing bed wt per unit area and with superficial gas vel. Typical figures were: size, 170 mesh; bed wt per unit area, 32 lb/sq. ft.; max removal eff >90%; superficial vel, 3 f.p.s.; pressure drop across bed, 6 in water. Behaviour of NH_4NO_3 smokes showed similar results to that of acid mists. R. G. T.

1589. New Hydrocarbon Syntheses Involving Carbon Monoxide. N. D. Zelinskii. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 235–237.—A brief review of recent Russian work on the mechanism of the reduction of CO. Investigations with Co, Ni, and Fe cat, involving measurement of the reaction kinetics of: (1) hydrocarbon formation from CO and H_2, (2) carbide formation by reaction of CO with the cat surface, and (3) reduction of carbide by H_2, indicate that carbide is not an intermediate reaction stage with Co and Ni cat, but that with Fe cat there is a relationship between the rate of carbide formation and the rate of hydrocarbon synthesis. On the surface of the Co cat reaction of CO with H_2 leads to formation of CHOH, which is reduced to CH_2 and H_2O. Two new reactions involving the CH_2 radical have been discovered: (*a*) the hydrocondensation of CO with olefins and (*b*) the hydro-polymerization of olefins in the presence of small amounts of CO. Both reactions yield saturated and unsaturated aliphatic hydrocarbons and indicate the role of the CH_2 radical in the Fischer–Tropsch process. V. B.

1590. Lion Oil Expands Chemical Facilities at El Dorado. D. H. Stormont. *Oil Gas J.*, 14.7.49, **48** (10), 105.—Brief outlines are given of the new facilities for chemical production at the Lion Oil Co.'s plant at El Dorado, Ark. The expansion is estimated to cost $6,300,000. The programme provides: a 30% enlargement of the anhydrous ammonia plant to 750 tons per day; 1300-ton spheres for ammonia storage; a sulphuric acid plant to produce 200 tons per day of acid; an ammonium-sulphate plant for neutralizing 100 tons per day ammonia, producing 380 tons per day ammonium sulphate. Storage for 4000 tons of the latter will be made. Extensive revision and remodelling of the ammonium-nitrate-pelleting plant is under way. Large additions to the ammonia solution plant include a battery of aluminium tanks for storage and blending, which will help improve product quality. Sixteen aluminium tank cars for transport of the nitrogen fertilizer solution have been received, forty more are on order. Corrosion-resistant aluminium is also being used for plant and storage purposes. Internal components of a new, and better, design in the ammonia-synthesis converters have been added as well as new superheaters, utility lines, railroads, etc. Over 125,000 tons of synthetic ammonia have been produced yearly. The expansion permits an additional 50,000 tons of ammonia to be marketed. Four illustrations of the plant under construction are shown. W. H. C.

1591. The Technology of Mixing. D. W. Van Krevelen and J. Huiskamp. *De Ingenieur*, 5.8.49 (31), CL 6–12.—The first article of a series on the above subject sub-headed "Action of the stirrers."

Although there is a wide range of stirrers, they are based chiefly on the three following types: paddle, propeller, and turbine.

Examples of each type are given and discussed, with diagrams and quoted specifications.

Further information on the action of the stirrers is given and illustrated.

A. H. B.

1592. From Natural Gas, Steam, Air, Spencer Chemical Co. Manufacture Ammonia, Ammonium Nitrate, Methyl Alcohol, Dry Ice. K. B. Barnes. *Oil Gas J.*, 4.8.49, **48** (13), 40.—The petrochemical plant of the Spencer Chemical Co. in Kansas is described.

Natural gas is purchased from Cities Services gas pipelines originating from gas fields of Texas, Oklahoma, and Kansas, and by early 1950 between 20 and 45 million cu. ft. per day will be processed.

Five principal operations are carried out, involving gas reforming, ammonia, nitric acid, and ammonium nitrate production, and graining of the nitrate by kettle agitation.

G. A. C.

Metering and Control.

1593. Mass Spectrometer for Continuous Gas Analysis. J. A. Hunter, R. W. Stacy, and F. A. Hitchcock. *Rev. sci. Instrum.*, 1949, **20**, 333–336.—The gas sample is pulled through a hypodermic needle and past a leak by a small vacuum pump. A portion is drawn into an ion source, and the ions are deflected by a magnetic field to fall on collector plates. After amplification the output is fed into mirror galvanometers which reflect light beams on to a moving strip of photographic paper.

Details of the leak and the vacuum system, which is capable of producing a vacuum of 5×10^{-6} mm Hg, are described. The ionization chamber is designed so that there is an appreciable resistance to gas flow into the main vacuum chamber, thus enabling a comparatively high pressure to be used in the ionization chamber and permitting the use of an oil-diffusion pump. The spectrometer tube, receiver assembly, and electronic components are of standard construction and are briefly described.

High accuracy is not claimed for this instrument, but its response is good. An instantaneous change in gas composition will appear on the record with a lag of less than 0·2 sec and requires approx 0·1 sec to settle on the new value. H. C. E.

Safety Precautions.

1594. Automatic Flame Control. Anon. *Mech. World*, 5.8.49, **126** (3264), 143.—The most serious explosion hazard in connexion with oil- and pulverized-fuel-fired oven and furnace equipment is from the fuel supply. In recent years two-thirds of explosions reported occurred during lighting-up operations. To avoid such occurrences two precautions are recommended, viz., provision of automatic pilots or use of flame-failure devices which ensure that gas cannot be delivered to burner until a flame is sufficiently close as to cause ignition. These also ensure that gas supply is automatically cut off if flame goes out. Second precaution comprises use of low-pressure cut-off valves to cut off gas supply if pressure at burner falls below that required to maintain the flame. Various types of automatic pilots and flame-failure devices are available, and a number of these are described and illustrated. A. S.

Products.

Chemistry and Physics.

1595. Experimental Study of Thixotropy in Bentonite Suspensions. J. Alfrey, Jr. and C. W. Rodewald. *J. Coll. Sci.*, 1949, **4**, 283–298.—The torsional pendulum thixotrometer used in this investigation consisted of a cylindrical brass shell suspended by a torsion wire between two concentric stationary brass shells. The moving cylinder was equipped with a horizontal pointer moving over a scale, and in use it was turned through a known angle, released, and readings of angular displacement were taken every 5 sec. The movable cylinder was turned by hand to agitate the bentonite

suspension in the apparatus so that readings could be taken immediately after agitation ceased.

It was found that: (1) immediately after agitation the suspensions behaved as Newtonian fluids; (2) a yield point developed when the suspensions were allowed to set for 2 min; (3) suspensions differed markedly in setting times, which do not depend on the original fluidity of the suspension; (4) ageing of the suspension for periods up to three days decreased its fluidity but increased the time required for gelation after agitation; (5) ageing is irreversible, and its rate depends on temperature; gelation is reversible; (6) 1% of dioxane greatly reduced the fluidity and the tendency towards gelation, but 1% of alcohol had no affect.

A theoretical discussion on thixotropy in general is given. H. C. E.

1596. Simultaneous Oxidation of Methane Carbon Monoxide and Hydrogen in a Porcelain Tube. B. A. Zakharov and L. I. Duruinina. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 1539–1541.—A H_2–CH_4 mixture requires a considerably higher temp for combustion than does H_2 alone, the continued presence of H_2 in such mixtures can be detected up to 720° C, this is due to partial oxidn of CH_4 to CO + H_2. A mixture of CH_4 (1·6%), H_2 (1·51%), and CO (0·84%) fed at 170 ml/min was burnt at atm pressure in a porcelain tube 15 mm dia and 500 mm long. Ratio of O_2/total combustible gases was 4·5, temp was in range 400–800° C. 670° C was found to be a crit temp below which partial oxidn of CH_4 to CO + H_2 occurred and above which CH_4 was almost completely burnt to CO. Increase of oxidn of CH_4 with rise in temp below 670° C is 1·6 times slower than above. The H_2/CO ratio in the products of the incomplete combustion of CH_4 falls from 4 to 0 with a temp rise from 450° to 690° C. Complete oxidn of the mixture occurs at 760° C, the components being eliminated in the following order, CH_4, H_2, CO. V. B.

1597. Oxidation of Tri*iso*butylene. A. P. Meshcheryakov. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 399–400.—The tri*iso*butylene obtained by Butlerov (*J. Russ. Phys. Chem. Soc.*, 1879, **11**, 197) has been shown by Whitmore (*J. Amer. Chem. Soc.*, 1941, **68**, 2045) to be a mixture of 1 : 1-di*neo*pentylethylene and 2 : 2 : 4 : 6 : 6-pentamethyl-3-heptene. Oxidn of tri*iso*butylene under varying degrees of severity yielded acid mixtures of different m.p., the yield decreasing with rise of m.p. The higher m.p. acids (91–94° C) obtained by the milder selective oxidn conditions (20° C, 6 vol 50% H_2SO_4 with gradual addition of an equal wt (on the hydrocarbon) of $K_2Cr_2O_7$) contain a greater proportion of methyl-*tert*-butyl*neo*pentylacetic acid. Previous work is reviewed. V. B.

1598. Volumetric Behaviour of Benzene. J. W. Glanville and B. H. Sage. *Industr. Engng Chem.*, 1949, **41** (6), 1272–1273.—Determination of the sp. vol. of C_6H_6 at seven temps between 100° and 460° F and pressures between v.p. and 10,000 p.s.i. is described. Tabular results and description of method are included. R. G. T.

Analysis and Testing.

1599. Method of Analysis of Absorber Oils for Calculating Stripping and Absorption Efficiences. J. V. Brubaker. *Oil Gas J.*, 21.7.49, **48** (11), 90.—The method described permits the use of a lean or fat oil sample sufficiently large to provide measurable quantities of pentane and lighter gases for distillation in an ordinary low-temperature fractional-distillation column and provides sufficient depentanized bottoms for checking reclaimer efficiency.

Typical analysis on lean oil is tabulated. G. A. C.

1600. Determination of Asphaltic Materials in Petroleum and Petroleum Products. J. Moos. *Erdöl u. Kohle*, 1949, **2**, 345–357.—Various pptn tests for "asphalt" and the different definitions that have been given of this material are discussed. Considerable confusion has occurred in the past due to the many precipitants in use and the differences in terminology. The effect of the precipitant in eliminating the action of protective colloids is likewise of significance. Asphalts can also be determined by adsorption methods. Tests were made on a Nienhagen mixed-base waxy crude (full inspection given) topped (60·5%) to 130° C (20 mm). Solvents used were *cyclo*hexane,

"normalbenzin," diethyl ether, dioxan, propane, and acetone yielding the following amounts (%) of ppt: nil, 0·6, 2·1, 7·0, 14·9, 22·5. Solvent/oil ratio and the pptn temp were 40/1 and 15° C, except in the case of propane (50/1, 75° C). The high solvent power of *cyclo*paraffins for asphaltenes is thus confirmed. The variation in ppt (2·8–9·2%) with temp is especially marked in the case of dioxan. Wax in the ppt was determined by dissolving the latter in CS_2 and then spraying the solution into glacial acetic acid at 45° C, in which the wax is sol and the asphaltenes insol. Wax content (%) of the ppt was as follows: nil ("normalbenzin," propane), 6·1 (diethyl ether), 17·9 (dioxan), 12·1 (acetone). Analyses of the ppt by the Suida–Pöll procedure (*Petroleum Zeit.*, 1933, **33** (10), 1) are given. The asphaltic material precipitated by pet ether from the dioxan filtrate had an ash (2·2%) high in silica (59·5%) and nickel (6·5% as NiO). In the adsorption tests, carried out in a 500 × 10 mm tube packed with alumina, topped crude was dissolved in 10–14 parts of pet ether (30–50° C); the column was successively eluted with pet ether (oil and wax), chloroform (resins), and pyridine–CS_2 (asphalts), total recovery being 99·9%. Results of numerous tests under varying conditions are tabulated, giving an overall picture on the topped crude of 86% oil + wax and 14% resins + asphaltic matter. Using a 1-g sample the average test error (10 tests) was ±0·7%. Temp coeff of elution is small and may be neglected. Creep losses were studied, and an apparatus for minimizing creep when evaporating solvent is illustrated. Elementary analyses of the crude and of many of the fractions pptd therefrom are given. A comparison of results obtained by pptn and adsorption methods shows these to be closely comparable, provided that the filtrate from the pptn tests is included in the analyses. About ninety references.

V. B.

1601. A Critical Analysis of Methods of Determination of Water Dew Point in Hydrocarbon Gases. F. C. Riesenfeld and H. D. Frazier. *Oil Gas J.*, 28.7.49, **48** (12), 238.—An outline is given of the many difficulties that may arise through the presence of water in the transmission and processing of natural gas. Three methods for reducing the water content of hydrocarbon gases are described. The method considered herein being liquid dehydrators, *i.e.*, diethylene glycol, alone or with ethanolamine. All dehydrating processes require accurate analytical control, and a number of methods and instruments for determining the water content are available. Chemical methods are outlined, and instruments for the purpose are described. They include the infrared spectroscope and electrical-conductivity instruments. More usually, however, instruments for determining the dew-point are employed. Two types, the pressure variant and the temperature-variant (the Bureau of Mines apparatus is the latter type) are described as to their functioning and in relation to the dehydration process employed. The authors have found that the values obtained by such instruments do not give true results with samples from liquid dehydrators. There is a lack of correlation of the indicated water content with the hydrate-formation temperature of such gases. A theoretical explanation for the phenomena is given. A new analytical procedure has been developed which determines the absolute water content of gases effluent from liquid dehydration systems. The apparatus is illustrated and described. The procedure is described, and the calculations are shown. The reagents employed are: anhydrous magnesium perchlorate and 0·02N-solutions of sulphuric acid and sodium hydroxide. Five charts of the equilibrium data of liquid dehydration systems are shown.

W. H. C.

1602. Hydrocarbon Analysis. IV. Analysis of Gaseous Hydrocarbons. H. Grosse-Oetringhaus. *Erdöl u. Kohle*, 1949, **2**, 286–299.—A procedure for analysis of gas mixtures, including the lower hydrocarbons, is described in detail. Sampling can either be spot or continuous. Analysis is on conventional lines; magnesium perchlorate is used as drying agent, and among the chemical procedures used are absorption of unsaturated hydrocarbons in a solution of Br in KBr and of O_2 in chromous chloride. Distillation of light hydrocarbons is carried out in a wire-packed column 700 mm high and 8 mm dia. Operating technique is given at some length, and numerous figures illustrate the apparatus used. Separation of fractions may be carried out at either above or below atm pressure. (Cf. Abstract No. 286.)

V. B.

1603. Patents. W. M. Mercer. B.P. 614,561 of 31.12.48. Apparatus for determining the initial boiling point of liquids.

W. M. Zaikowsky. B.P. 614,633 of 31.12.48. Exhaust gas analysis.

K. Fischer. B.P. 615,413 of 19.1.49. Flowmeter.

K. Fischer. B.P. 615,414 of 19.1.49. Viscosimeter.

K. Fischer. B.P. 615,518 of 19.1.49. Specific gravity indicator. G. R. N.

Crude Oil.

1604. The Analysis of Crude Oil in Poland with Special Regard to its (Lub) Oil Components. R. Glaser. *Nafta*, May 1948, **4**, 189–193 (from the work of (Polish) Petroleum Institute).—The author describes two methods (Poll's and a modified one) in both of which solvents and earths are used to separate the paraffinic, bituminous, and asphaltic components of Polish crudes.

A table of results of analyses carried out on seven different crudes is appended. M. S.

Gas.

1605. Natural Gas as Motor Fuel for Internal Combustion Engines. J. Kwietniewski. *Nafta*, May 1948, **4**, 187.—Author lists possible alternative gaseous fuels for spark-ignition and compression-ignition engines, and considers their merits, alterations to engines necessitated by their use, and gives simple formulæ to calculate the consumption of gas and the power produced by various fuels. M. S.

Engine Fuels.

1606. Diesel Fuel Additives. Anon. *Auto. Engr*, July 1949, **39** (516), 264.—Tests made to evaluate additives for improving cold-starting characteristics of diesel fuels. A three-cylinder two-stroke engine was installed in a cold room, and by thermostatic control of electric heaters and circulation of refrigerant any engine temperature between 0° and 80° F could be produced. Constant cranking speed of 190 $\pm$ 10 r.p.m. adopted for all tests with 1 min as maximum time for starting. With non-additive fuels an increase of 10 Cetane No. lowered permissible starting temperature about 12° F. Lowest starting temperature to be expected without starting aids was about 15° F even when using premium-grade kerosine-type fuel. Addition of certain volatile materials improved starting, provided volatile material had good ignition quality. Normal heptane was effective, but equally volatile *iso*-octane impaired starting ability. Various chemical additives tested included volatile and nitrated compounds, organic peroxides, oxidized kerosine and white mineral oil, sulphur compounds, and diethylene glycol mono-methyl ether, diethylene glycol di-ethyl ether, diglycerol, methyl formate, copper naphthenate, allocimene, and piperylene. None of these was effective in concentrations less than 10%. General conclusion is that use of additives is not very attractive, particularly in view of good results obtained by vaporization of certain starting aids directly into air-induction system. By these means diesel engines can be started at −40° F. A. S.

1607. Knock in Internal Combustion Engines. A. C. Egerton and N. P. W. Moore. *Nature*, 1949, **163**, 917.—Nitrogen and hydrogen peroxides have a strong pro-knock effect when added to methane–air mixtures during experiments on a Gardner L2 C.I. engine converted to spark ignition. The effect could be suppressed by T.E.L., which was also effective when running on weak hydrogen–air mixtures. These experiments confirm those made by Downs and Walsh (Abstr. Nos. 481, 1044, 1949). H. C. E.

Gas Oil and Fuel Oil.

1608. Patent. Valor Co., Ltd., and H. Holland. B.P. 618,139 of 2.3.49. Pressure burners for liquid fuel. G. R. N.

Bitumen, Asphalt, and Tar.

1609. Patents. J. Groenendijk. B.P. 614,578 of 31.12.48. Method of and apparatus for the regeneration of bituminous or tar containing materials.

Texaco Development Corpn. B.P. 617,062 of 16.2.49. Impregnation of absorbent materials with bituminous compositions. G. R. N.

Derived Chemical Products.

1610. Fluorolubricants. Anon. *Chem. Ind.*, July 1949, **65** (1), 35.—A new range of oil- and grease-like polymers of fluorocarbons have been announced. They vary in appearance from water-white mobile liquids to tough wax-like materials at room temperature, and are extremely inert both chemically and thermally. The properties of the three basic " Fluorolubes " are described. O. M.

Coal, Shale, and Peat.

1611. Method of Assaying Oil Shale by a Modified Fischer Retort. R. E. Stanfield and I. C. Frost. *U.S. Bur. Min. Rept. Invest.* 4477, 1949, pp. 13.—This method is similar to the previous Bureau of Mines method (R.I. 3977) for determining oil yield from oil shale, but has several advantages. It takes only about 2 hr for a complete assay instead of 6 hr by the previous method; a 100-g or even a 50-g sample can be used instead of 350–450 g; more precise control is possible; results are more reproducible; and a higher oil yield is obtained. G. S.

Miscellaneous Products.

1612. Acrylic Resins (Part II). C. T. Kautter. *Brit. Plastics*, July 1949, **21** (242), 390–396.—Continuing this article the technology of moulding acrylic glass-like products is discussed. In general, with increasing thickness of laminate, lower polymerization temperatures are required, so that heat transfer, and thus the degree of polymerization, can be controlled throughout the bulk of the material being moulded. Following moulding, the sheet is checked for optical properties, disturbances being immediately apparent when the sheet is viewed from an angle. From this aspect the important considerations are : mould design, state of solution to be polymerized, and temperature control during polymerization.

The article goes on to describe various methods of polymerization, the manufacture of safety glass, and also emphasizes the ease of working which is characteristic of these resins. O. M.

1613. Corrosion Prevention. Anon. *Auto. Engr*, July 1949, **39** (516), 280.—Powerful inhibitor against corrosion of iron, steel, and other metals between manufacturing stages, during storage, and in packages for shipment has been developed by " Shell." It is known as V.P.I., and is a white crystalline, stable organic compound, which very slowly vaporizes into an odourless, non-toxic, and non-injurious vapour. This completely surrounds any article in an enclosed space and prevents corrosion by moisture or air. Direct contact of solid V.P.I. with metal is not required, and it continues to protect even if wrappings are punctured. V.P.I. acts by forming an invisible thin protective film on the metal, and the film is maintained as long as V.P.I. is present in surrounding atmosphere. Even when water condenses on steel, surface corrosion is prevented by V.P.I. dissolving in water and making water non-corrosive to steel. Protection by V.P.I. can be extended over many years, and tendency for vapour to escape from wrapper is slight. V.P.I. is available in powder or solution form but most economical form is in coated wrapping materials. Heavy cloths impregnated with concentrated solution and then dried can be used for storage of equipment or materials in process. V.P.I. also applicable to aluminium, duralumin, and chromium plate. A. S.

1614. Ethylene Glycol—(Commodity Survey.) J. R. Skeen. *Chem. Engng*, 1949, **56** (5), 357–358.—Production of ethylene glycol has been recently expanded. Main outlet is as anti-freeze. Other uses are in explosives, cellophane, brake fluids, and radio-condenser liquids. Two processes in general use for large-scale production are briefly mentioned. The history of its production concludes the survey. R. G. T.

1615. Patents. Shell Development Co. B.P. 616,530 of 2.2.49. Cement or adhesive compositions.

J. C. Arnold (Standard Oil Development Co.). B.P. 616,886 of 9.2.49. Synthetic rubber compositions.

N.V.B.P.M. B.P. 617,508 of 23.2.49. Compositions comprising halogen-containing high molecular substances.

N.V.B.P.M. B.P. 617,620 of 23.2.49. Stabilized compositions containing polymers which evolve hydrogen chloride on decomposition.

N.V.B.P.M. B.P. 617,891 of 23.2.49. Manufacture of co-polymerization products of homogeneous composition. G. R. N.

Engines and Automotive Equipment.

1616. American Small Two-Stroke Uniflow Diesel. Anon. *Gas Oil Pwr*, 1949, **44**, 155.—The P & H diesel engine is constructed in two types—387C and 687C—as three- and six-cylinder engines. The continuous ratings are 60 and 120 b.h.p. at 1280 r.p.m., and the top outputs are 70 and 140 b.h.p. at 1400 r.p.m. The cylinders have dimensions 4½ in dia by 5½ in stroke, and the compression ratio is 16 : 1.

A constructional feature of this engine is that for each cylinder the head, liner, and water-jacket are inserted and withdrawn as one assembly. Crankcase and cylinder-block are cast in aluminium alloy as a single unit. The pistons are of cast aluminium alloy fitted with three pressure and two oil-control rings. Fuel injection is by individual pumps, and the injectors are of the single-hole type. Full pressure lubrication is provided to main and big-end bearings, camshaft, timing gears, and valve mechanism. H. C. E.

1617. Armstrong-Siddeley Air-Cooled Twin [Diesel Engine]. Anon. *Gas Oil Pwr*, 1949, **44**, 188.—The cylinder dimensions of this four-stroke engine are 4½ by 4½ in, and the compression ratio is 15 : 1. Its top output is 16 b.h.p. at 1200 r.p.m., and the dry weight is 725 lb. Air-cooling is provided, and lubrication is by gear-type pump. The fuel system consists of two C.A.V. injectors and fuel-pumps, the delivery of which is controlled by an automatic centrifugal-type governor. H. C. E.

1618. 40 H.P. Locomotive. Anon. *Gas Oil Pwr*, 1949, **44**, 180.—A small shunting locomotive built by Fowler & Co., Ltd., uses a Marshall single-cylinder horizontal two-stroke engine. The 6½-in cylinder generates 40 b.h.p. at 750 r.p.m. and crankcase compression and loop-scavenge are employed. Torque is transmitted through a 3-speed gear-box giving speeds of 3·2, 5·6, and 9·7 m.p.h. H. C. E.

1619. Modernized National Four-Stroke Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 160–163.—The National 4A class of engines has been modified to give greatly increased output at lower specific fuel consumption. The cylinder bore has been increased from 8 to 9 in, and the head has been provided with four valves, thus allowing the engine to run at higher speeds without a falling off in torque. The new R4A range extends from three to eight cylinders, with a power range of 125–816 b.h.p. on the 12-hr rating.

Constructional details of the engines are given. The two exhaust valves per cylinder are so arranged that although both connect to one passage each valve guide has to deal only with the heat from its own spindle. Starting is by a compressed-air device attached to the camshaft. A suction pump delivers lubricating oil through a strainer to the distribution main, and streamline filters operate on a by-pass line. A comprehensive water-cooling system is provided. H. C. E.

1620. New Quick-Running Diesel Engine of 150 B.H.P. Anon. *Gas Oil Pwr*, 1949, **44**, 171.—This six-cylinder A.E.C. engine has cylinders of bore 130 mm and stroke 142 mm, and gives a top output of 150 b.h.p. at 1800 r.p.m. The compression ratio is 16 : 1.

Lubrication is by combined pressure and splash systems. A gear-type oil-pump delivers lubricant to the main and big-end bearings and to the bearings of the pump

idler wheel and the timing-gear train. Oil at lower pressure is supplied to the overhead-valve gear, from which the excess lubricates the camshaft bearings. Pistons, gudgeon pins, and timing-gear teeth are splash lubricated.

A toroidal combustion chamber is formed within the piston crown, and fuel is injected into it from a four-hole nozzle. Air-swirl is promoted during the induction stroke by using masked inlet valves.

Constructional details of the engine are given. The unit is water-cooled.

H. C. E.

1621. Powerful High-Speed Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 164.—Designed for use in large civil-engineering equipment, drilling rigs, etc., this Cummins NVHS-1200 type engine has a maximum output of 550 b.h.p. at 2100 r.p.m. It is a twelve-cylinder Vee pressure-charged four-stroke model of cylinder $5\frac{1}{2}$ in dia and 6 in stroke, and has a compression ratio of $13\frac{1}{2} : 1$. The small angle of 40° between cylinder banks was chosen to minimize torsional vibrations over a wide speed range. Various constructional details are given. H. C. E.

1622. Railway Oil Engines of Medium Power. Anon. *Gas Oil Pwr*, 1949, **44**, 177.—Built by the English Electric Co., Ltd., the RK and RKT types of oil-engine for general industrial and traction purposes respectively have cylinder dimensions of 10 in bore by 12 in stroke. There are four or six cylinders, and the range is from 266 to 880 maximum b.h.p. at 750 r.p.m. The units are pressure-charged on exhaust-gas turbo-principles.

Constructional materials and assembly details are given. Drives from the free end of the main shaft lead to the centrifugal water-pump and the two gear-type lub. oil pumps, by means of which pressure lubrication is provided to all working parts.

H. C. E.

1623. The Ruston Gas Turbine. Anon. *Mech. World*, 20.8.49, **126** (3267), 229.—A simple open-cycle gas turbine has been developed and produced by Ruston & Hornsby, and has been installed in one of the firm's power-stations, where comprehensive testing started in June 1949. It has continuous full power rating of 1070 b.h.p., and has been designed as a general-purpose prime mover having long life, simplicity and low first cost, and good efficiency at full load and down to about 40% load. The basic engine consists of a thirteen-stage axial flow compressor delivering air through contra-flow tubular type of heat exchanger to twin combustion chambers. A two-stage turbine drives the compressor, and the exhaust from this turbine passes through two-stage power turbine from which the drive is taken through epicyclic reduction gearing. The exhaust from the power turbine is ducted back through the heat exchanger to atmosphere. Machine can be operated with or without heat exchanger with little modification. Fuel system is capable of operating satisfactorily with fuels of a wide range of viscosity, and development of a combustion chamber to burn the heaviest grade of residual fuel is now in an advanced stage. Complete plant weight as installed in a power-station ready for service is $17\frac{1}{4}$ tons including the alternator.

A. S.

1624. Single Cylinder Agricultural Oil Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 179.—The Bamford Z2 engine develops $4\frac{1}{2}$ b.h.p. within a cylinder of $4\frac{1}{2}$ in bore and 5 in stroke and a compression ratio of 16·7 : 1. The piston crown has a double toroidal cavity, and injection is through a four-hole nozzle at 125 atm by a C.A.V. injection pump. Fuel consumption is 0·4 lb per b.h.p.hr. The pair of vertical valves is operated by a single cam.

Three diagrams illustrate the constructional details. H. C. E.

1625. Simple Pressure Lubricator. Anon. *Gas Oil Pwr*, 1949, **44**, 183.—This lubricator has adjustable individual feeds to a total of six, is automatic in action, and oil is delivered without recourse to ball valves and springs. It is suited to oil-engines, tractors, compressors, etc.

The barrel distributor shaft, rotated by the main driving shaft, comprises a hollow body and a face cam which actuates in succession six plungers situated radially round the barrel. Oil from an external supply enters the barrel through one of six upper

radial holes and thence flows via one of the lower radial holes to the space beneath a plunger, which is at that time lifted by the cam to its upper position. As the barrel rotates the lower hole closes and the plunger descends, forcing the oil through the upper plunger port into the oil-outlet connexion and thence by piping to the feed point.

When the plungers are adjusted for maximum stroke the device will deliver 0·06 cc per stroke, giving 1·2 cc per min at the maximum distributor shaft speed of 20 r.p.m. against a permissible back pressure of 150 p.s.i. The provision of a spring-loader handle enables the lubricator to be hand-operated for priming purposes.

H. C. E.

MISCELLANEOUS.

1626. Automatic Control Instruments. Anon. *Mech. World*, 5.8.49, **126** (3264), 166.—With increased use of automatic controllers it is necessary to devote more thought and action to proper maintenance. This can be achieved by preparing a scheme for "preventative maintenance" whereby each instrument in a factory is inspected, cleaned, and tested at regular predetermined times. A list of general rules for instrument maintenance is given. A. S.

1627. Cost-imating Chemical Equipment—1. W. L. Nelson. *Oil Gas J.*, 11.8.49, **48** (14), 109.—No. 43 in the series gives tables showing approximate costs of installed evaporators, dryers, Gray-Jenson spray dryers, crushing and grinding equipment, and Swanson-Walker crystallizers, for various surface areas, capacities, and horse-powers where applicable. G. A. C.

1628. Cost-imating Construction Costs 1948–49. W. L. Nelson. *Oil Gas J.*, 21.7.49, **47** (11), 101.—No. 40 in the series lists approximate price indices for 1947, 1948, and 1949 for various materials or equipment showing reference to complete index in previous issues of the *Oil and Gas Journal*. Throughout the series, price index for 1946 has been taken as 100. G. A. C.

1629. Corrosion Protection of Oil-Refining Equipment. H. P. Zeh. *Oil Gas J.*, 11.8.49, **48** (14), 99.—Use of condensed record of past corrosion experience in refinery units is stressed, and a table shows corrosion data on a crude distillation unit for the period 1939–46, in part, the actual record covering over 100 parts of the equipment.

Corrosion reference points and plant-corrosion tests are desirable, the former being provided by installation of test pieces of metal. A table shows corrosion rates of such specimens.

Corrosion tests on pilot plants by means of which correct materials for the process are selected result in practically trouble-free full-scale plant operation. G. A. C.

1630. Cooling of Quenching Oils. C. L. Ringquist and L. J. Hess. *Heating Ventilating Engr*, July 1949, **46** (7), 49.—In cooling quenching oils the problem is principally one of the removal of heat from quenching bath. Method of cooling should provide year-round operation and uniform bath temperatures. Method of cooling depends on quenching bath temperature, and four recommended systems are described and illustrated, viz., (i) use of evaporative cooler, (ii) use of shell and tube heat exchanger, (iii) use of evaporative cooler supplemented by heat exchanger and refrigeration, and (iv) use of 100% refrigeration. It may be necessary to provide facilities to heat the bath after periods of system shutdown, and three systems of oil preheating to operating temperature are described. Finally, a formula is given from which can be determined the required quantity of oil to be circulated. A. S.

1631. Hurricanes. K. Shisler. *Oil Gas J.*, 30.6.49, **48** (8), 64.—To secure all equipment and evacuate personnel from offshore locations in the event of hurricanes or tropical storms, accurate advance weather reports are necessary. The problems of the meteorologist in making estimates of evacuation periods, etc., are outlined.

C. G. W.

1632. Marine Corrosion Tests Show Practical Results. G. Weber. *Oil Gas J.*, 28.7.49, **48** (12) 236.—Increasing interest is being shown by the petroleum industry in the

Kure Beach testing station of the International Nickel Co., and the Dow Chemical Co., near Wilmington, N.C. Six illustrations show parts of the installation at which research on corrosion and its combating is carried out. Coated and plain, alloy and metal specimens are totally or partly immersed in the tidal basin or are subjected to tidal movement. Condenser tubes are subjected to high-and low-velocity impingement tests by means of pumps. Atmospheric and salt-water-spray tests are conducted in forty racks holding over 36,000 specimens, 800 yards away from the basin. Marine growths are studied at Wrightsville beach, nearby. The contribution Kure research has made to the oil industry is described. It covers: recent developments in exploitation, development, and refining of petroleum, marine drilling equipment protection, cathodic protection by zinc and magnesium anodes, studies to find the best magnesium alloys for specific uses and fundamental research on polarisation. Protection of piling and piers at Freeport, Texas, show cost of cathodic protection by magnesium to be 2 cents/sq. ft./year, and adequate underwater protection by only 2 mA/sq. ft. compared with 3 mA/sq. ft. in the past. The recommended protection programme is described, it includes monel-metal sheathing on the parts exposed to tidal fluctuation, with the ends sealed with pitch and the annular space between sheath and piling filled with heavy sweet oil. For alloys and metals used where seawater is the cooling medium, zinc is used for cathodic protection. Zinc anodes of 99·99% purity give three times the protection afforded by 99·9% purity zinc. Cupro-nickel modified with iron, to the specification given, far outclasses aluminium–brass for condenser tubes. Many other examples of the research results are outlined. W. H. C.

1633. Economics of Thermal Reforming. G. E. Feuchter. *Oil Gas J.*, 21.7.49, **48** (11), 62.—The manner is outlined in which the most economical combination of thermal reforming and T.E.L. addition is determined, and illustrates the effects of product prices, T.E.L. cost, and O.N. specification upon the economics of thermal reforming.

It is concluded that: (1) maximum profits are obtained when charging 3000 b.d. of heavy naphtha, equivalent to 275–400° F boiling range operating at a reforming severity equivalent to an O.N. increase of reformate of about 140; (2) O.N. specification has a relatively large effect on economics of thermal reforming; (3) decrease in gasoline price increases the attractiveness of thermal reforming, which is (4) considerably more attractive when the price of butane is high than when it is low and (5) economics of the process vary with individual refiners depending on type of crude and equipment. G. A. C.

1634. Where to Find Information on Mineral Raw Materials. M. M. Leighton. *Chem. Ind.*, June 1949, **64** (6), 930.—An article explaining the procedure for obtaining information on mineral resources of America. A comprehensive list of reference-works is attached. O. M.

1635. Patents. National Oil Products Co. B.P. 615,254 of 19.1.49. Reclaiming waste wax paper.

Chemical Engineering and Wilton's Patent Furnace Co. and T. O. Wilton. B.P. 616,730 of 9.2.49. Production of hard pitch and oils from medium soft coal tar pitch. G. R. N.

BOOK REVIEW.

An Introduction to the Gas Turbine. D. G. Shepherd. London: Constable and Co., Ltd., 1949. Pp. ix + 387. 24*s*.

More than in any other type of power plant, the success of gas-turbine design depends on the quantitative application of thermo and aerodynamics. In order to appreciate, therefore, the design methods and performance characteristics of gas turbines, it is necessary to have more than a nodding acquaintance with these two subjects, in addition to an appreciable knowledge of stress theory, high-temperature metallurgy, and combustion.

In the face of such stringent requirements it is encouraging to the reader to find that the author has produced a book which, while leaving little or nothing for granted to the uninitiated, does not so labour elementary theory as to bore the more familiar student. A considerable measure of success has been achieved in producing a work which will have a very wide appeal and at once serve the purpose of an introduction to the subject and a book of reference. In the latter respect the comprehensive bibliography at the end of each chapter is very valuable.

Whilst the book is, to a very large extent, inevitably concerned with the aero gas turbine, it is a pity that more references are not made to the particular requirements and peculiarities of other applications of the gas turbine. For instance, the dependence of the locomotive gas turbine on the successful development of a regenerative-type heat exchanger would have been worth mentioning, and more detailed discussion of industrial combustion chambers would have greatly helped redress the balance in the chapter on combustion. There is also a rather serious omission in the lack of emphasis on the importance of lay-out and duct design in the industrial and marine applications.

A short chapter on some of the mechanical difficulties met with in the development and operation of power units would have completed what is almost an encyclopædia of information on gas turbines. C. G. W.

BOOKS RECEIVED.

B.S. 545 : 1949. Bevel Gears (Machine Cut). London: British Standards Institution, 1949. Pp. 37. 7*s*. 6*d*. net.

This standard applies to machine-cut conical gears which connect intersecting shafts. Three classes are provided: A. Precision gears for peripheral speeds above 2000 f.p.m.; B. High-class cut gears for speeds below 3000 f.p.m.; C. Commercial cut gears for speeds below 1200 f.p.m.

Composition and Properties of Oil Well Drilling Fluids. Walter F. Rogers. Houston, Texas: Gulf Publishing Co., 1948. Pp. 525 + vii.

The uses, testing, and specifications of various types of drilling fluid are discussed and an extensive bibliography given.

Practical Petroleum Engineers' Handbook. Joseph Zaba and W. T. Doherty. 3rd Edn. Houston, Texas: Gulf Publishing Co., 1949. Pp. 654 + xiv.

A handbook of data covering the principal engineering requirements of the industry.

Principles of Petroleum Geology. Cecil G. Lalicker. New York: Appleton-Century-Crofts Inc., 1949. Pp. 377 + xii. $5.00.

The author is professor of geology at the University of Kansas, and the book covers the principles of petroleum geology, the mode and origin of oil and gas structures, and discovery methods.

A History of the Petroleum Administration for War, 1941–1945. Edited by John W. Frey and H. Chandler Ide. Washington, D.C. : U.S. Government Printing Office, 1946. Pp. 463 + xviii.

Deals with the organization of the P.A.W. and discusses mobilization of the oil industry in the U.S.A., the problems of supply and transport, distribution and marketing, manpower, production, refining. Much statistical and other data is given in appendices.

Butane–Propane Gases Handbook. Edited by Lynn C. Denny and Harold W. Wickstrom. 3rd Edn. Los Angeles : Jenkins Publications, Inc., 1947. Pp. 350.

The Reaction of Oxygen with Tar Oils. E. J. Dickinson and J. H. Nicholas. Road Research Technical Paper No. 16. London : H.M.S.O., 1949. Pp. 27 + iv. 9*d*. (postage 2*d*.).

Describes the first stage in the work of the Road Research Laboratory on means of improving tar road surfaces.

The Investigation of Atmospheric Pollution. A report on observations in the 5 years ended 31 March, 1944. London : H.M.S.O., 1949. Pp. 125 + vi. 2*s*. 6*d*. (postage 3*d*.).

Previous reports in this series covered one year, but there are advantages in covering a more lengthy period, and comparative data for 5-year periods back to 1914 are given.

During the war, restrictions on emitting pollution were partly relaxed without appreciable increase in smoke in the air. Ash deposition increased, probably due to boiler overloading and increased ash in the coal used. Many tables of statistics are given and also graphs relating to atmospheric pollution in Great Britain.

Proceedings of the Institution of Mechanical Engineers. Vol. 157, War Emergency Issues 25–36, 1947. London : The Institution, 1948. Pp. 530 + xi.

Papers included in this volume are : "Mechanical Engineering and the Oil Industry," by A. C. Hartley ; "Aeroplane Gas Turbines," by H. Constant ; "The Development of Gas Turbine Power Plants for Traction Purposes in Germany," by R. H. Bright ; "The Development of an Axial Flow Gas Turbine for Jet Propulsion," by D. M. Smith ; and "A Contribution to the Solution of the Gas Turbine Problem," by A. J. R. Lysholm.

Proceedings of the Institution of Mechanical Engineers. Vol. 158, 1948. London : The Institution, 1949. Pp. 516 + xi.

Papers of interest are : "The Gas Turbine as Applied to Marine Propulsion," by T. A. Crowe ; "Fuel Systems for Aero-gas Turbines," by E. A. Watson ; and "Journal Bearing Lubrication and Design," by A. S. T. Thomson.

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Oilfield Exploration and Exploitation.

Geology.

1636. Geological Interpretation of Exploratory Wells. P. Weaver. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1135–1144.—The presidential address given at the thirty-fourth Annual Meeting of the American Association of Petroleum Geologists at St. Louis on March 15, 1949.

To-day many wells are being drilled where there is little surface structure, so that to the three older questions: Are there shows of oil and gas, in what kinds of formation, and of what age? must be added: Does drilling confirm a favourable structure, and how is the well situated on the structure?

The author emphasizes the importance of obtaining all possible information about structure and faulting from core samples. New techniques are needed to locate structure in exploratory wells. The question should now always be asked: Is there lithological evidence of the application of stresses to the rocks other than the weight of overburden? E. N. T.

1637. Trends in Sedimentology. R. D. Russell. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1145–1153.—This is the presidential address presented at the twenty-third Annual Meeting of the Society of Economic Paleontologists and Mineralogists at St. Louis on March 15, 1949.

The trend away from qualitative field studies of sediments towards quantitative laboratory study, begun forty to fifty years ago, has become more pronounced during the last fifteen years. Although fruitful, this trend may cause the neglect of field work. Standardization and simplification of analysis methods are needed, together with closer integration of field and laboratory study. E. N. T.

1638. Problem of the Origin of Sulphurous Crudes. I. S. Mustafin. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 1015–1017.—Oil-bearing deposits are mainly to be found in tertiary and paleozoic strata, less frequently in mesozoic. S content of oil is independent of the age of the accompanying rocks. Ratio N/S is 8–12 for biological material, but in low sulphur (<0·5%) crudes it is usually 0·3–0·5 and rarely exceeds 1. Such crudes thus contain only "primary" S, and high S crudes have acquired "secondary" S from surrounding rocks by contact of biological material with inorganic sulphates. High S crudes will be those whose origin is linked with enclosed salt-water reservoirs in which sulphates are present. V. B.

1639. Mesozoic Igneous Rocks of Northern Gulf Coastal Plain. C. L. Moody. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1410–1428.—More than a hundred wells drilled in the Gulf Coast coastal plain have penetrated Mesozoic igneous rocks. Many of the known centres of later Mesozoic igneous activity, both outcropping and buried, are apparently the sites of ancient volcanoes which furnished to the depositional basins significant amounts of pyroclastic débris now in part preserved in the early and middle Gulf Cretaceous strata. The earliest igneous rocks of the Coastal Plain area may be of Triassic age; the latest were emplaced in late Austin or early Taylor time. E. N. T.

1640. Tectonics of North-Central States. D. Hager. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1198–1205.—The Interior Coal Basin of the United States is subdivided into the Indiana, Illinois, and Kentucky basins. In the Indiana basin, both northeast and northwest trends are important. North- and northeast-striking folds produce most of the oil in the Illinois basin, although northwest-striking folds and faults predominate in the Michigan basin.

In Kentucky, north- and east-trending folds govern the gas and oil production. In Iowa, northwest folding predominates.

All prominent uplifts, anticlines, domes, and faults in this area were largely in their present forms not later than the end of the Appalachian revolution in late Permian times. No comprehensive analysis of the tectonics of the area can be made until the detailed historical geology has been determined. E. N. T.

1641. Upper Jurassic of Northeastern Texas. F. M. Swain. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1206–1250.—The subsurface Upper Jurassic of northeastern Texas includes, in ascending order, the Eagle Mills, Smackover, Buckner, Bossier, and Schuler formations, the last two constituting the Cotton Valley group. The stratigraphy of the units in northeastern Texas is described in great detail, and structural contour maps and stratigraphic sections are presented, together with microphotographs of thin sections, photographs of fossils, and heavy mineral charts. E. N. T.

1642. Strand Line Accumulation of Petroleum. J. C. Freeman. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1260–1270.—Old strand lines furnish a distinct and important type of petroleum accumulation, and such accumulations are well demonstrated in the Laredo district of Texas. In Jim Hogg country, Texas, effective closure is present along strand lines, even through structural deformation of producing beds in many fields is secondary and may or may not serve to localize accumulation along strand lines. The methods applied in the Laredo area are applicable to other areas of similar geologic history. The study detailed in this paper is concerned with the Jackson and upper Yegua formations, which are Eocene in age. E. N. T.

1643. Paleozoic Geology of North and West Sides of Uinta Basin, Utah. A. A. Baker, J. W. Huddle, and D. M. Kinney. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1161–1197.—The Paleozoic strata on the north and west sides of the Uinta Basin range in age from Cambrian to Permian. On the west side of the Basin, in the southern part of the Wasatch Mountains, a Paleozoic section of some 40,000 ft is present only in an overthrust block. North and east of the thrust fault, in the central Wasatch Mountains and the Uinta Mountains, is a much thinner section of about 8000 ft of Paleozoic rocks.

Cambrian formations in the Wasatch Mountains include the Tintic quartzite of Lower Cambrian age, overlain successively by the Lower and Middle Cambrian Ophir formation and the Middle and possibly Upper Cambrian Maxfield limestone.

A persistent dolomite 150–265 ft thick overlies the Cambrian, and is provisionally correlated with the Jefferson dolomite of Devonian age.

The Madison limestone of lower Mississippian age and the Desert and Humbug formations of upper Mississippian age maintain fairly constant lithologic character along the west and north sides of the Uinta Basin. Post-Humbug Mississippian rocks have an aggregate thickness of about 4000 ft and include the Great Blue limestone and the greater part of the overlying Manning Canyon shale.

Pennsylvanian and Permian rocks include the uppermost part of the Manning Canyon shale, overlain successively by the Oquirrh, Kirkman, Diamond Creek, and Park City formations. The Oquirrh formation, about 25,000 ft thick, is mainly quartzitic sandstone with some interbedded limestone. The overlying Kirkman has a maximum thickness of 1600 ft, but the formation is absent locally. The Diamond Creek sandstone is a cross-bedded sandstone 800–1000 ft thick, which has been tentatively correlated with the Coconino sandstone. The Park City formation is about 1800 ft thick and consists of three distinct members. E. N. T.

1644. Geology and Development of the Poza Rica Oil Field, Veracruz, Mexico. G. P. Salas. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1385–1409.—The Poza Rica oilfield is the most important producing structure in Mexico. On the surface this structure is reflected in upper Oligocene clays, sands, and lenticular limestone of the Coalzintla formation. This structural nose dips east–southwest, and becomes more accentuated in the subsurface until the Tamabra limestone is reached. This limestone is Albian–Cenomanian in age, and production comes from a porous facies that crowns the axial zone.

This field is producing approx 100,000 brl of oil per day, and had an accumulated production of approx 8,943,167,855 cu. m. of gas and 50,754,198 cu. m. of oil to August 1948.

The geology of the Poza Rica area is described in detail, and geophysical, stratum contour, and isopachyte maps are given. E. N. T.

1645. Tectonics of Mexico. M. Alvarez, Jr. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1320–1335.—This paper presents a summary of the tectonics of Mexico as a whole.

It is divided into two parts: in the first are described in a general way the orogenic

processes to which the region of Mexico was subjected; in the second are described the major structural units, which are examined from a tectonic point of view, especially as to the character and orientation of their folds.

In the foreland of the Mexican geosyncline are three shelves, one large and too small massifs, and four basins. In the hinterland there is a major massif or continent, two large massifs, two medium-sized and four small massifs, and three basins. The foredeep of the geosynclinal fold has been shown in three regions, as established by the flysch-type sediments.

The geosyncline of the Mexican Cordillera begins west of Ciudad Juárez extending southward to Torréon, where it turns eastward to Monterrey, and from there southeastward to the Coatzacoalcos River, thence northeastward to the Chalchijapan River, and upon reaching the narrowest part of the Isthmus of Tehuantepec it turns southeastward into Guatemala.

The principal orogeny which gave rise to this folding started at the end of the Cretaceous in the northern part of Mexico and at the beginning of the Eocene in the rest of the country, and ended at the end of the Eocene except in the southeast, where it lasted until the beginning of the Oligocene.

A generalized tectonic map is presented. E. N. T.

Geophysics and Geochemical Prospecting.

1646. Geophysics, Geology, and Oil Finding. L. L. Nettleton. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1154–1159.—The important place of geophysics as a tool in oil exploration is now generally recognized. The operation of the partnership between geologist and geophysicist is relatively straightforward in reflection-seismograph exploration, but in geophysical methods based on potential fields (gravity and magnetic) the possible ambiguities are much greater. Close co-operation in the evaluation of such surveys should produce particularly fruitful results. Some specific examples of fault zones, uplifts, circular gravity maxima, and puzzling gravity minima are discussed. E. N. T.

1647. Photogeology in Gulf Coast Exploration. C. de Blieux. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1251–1259.—The Gulf Coast area of the United States is notable for the absence of surface geology and topographic expression of subsurface structure. With application of geomorphology as a basic principle, extensive aerial photographic interpretative techniques have been developed for this province. Photogeologic criteria for the deltaic plain of the Mississippi River and the adjacent coastal marsh are presented in detail, and four full-page aerial photographs of this area are shown. E. N. T.

Drilling.

1648. Casing Checks with Deep Tube Camera. R. Harwick. *Oil Gas J.*, 14.7.49, **48** (10), 88.—It is claimed that this camera will take photographs in dry wells, gas wells, or under water, under extreme conditions of 4500 p.s.i. and better than 200° F.

The apparatus is 6 ft long. Film camera, dry cells, and condensers are contained in a tube. Below the tube is a metal cylinder containing a plumb bob suspended over an inclinometer scale. Below this is the light source. The light source is similar to an Edgerton tube. Two bands of light illuminate the casing, one direct, opposite the light source, one indirect above the first and fading up the casing wall. Well deviation is shown by the inclinometer scale. A depth log is kept during the picture cycle. C. G. W.

1649. Economics of Oil Well Corrosion Control. R. J. Villagrana, and W. W. Messick. *Oil Gas J.*, 21.7.49, **48** (11), 58.—Factors influencing rate of corrosion include: (1) nature of electrolyte; (2) presence of stray currents; (3) hydrogen sulphide concentration; (4) acidity of well fluid. These, and in addition iron content of produced water, may be used as rough guide to extent of corrosion.

Costs of corrosion are: (*a*) direct—costs of labour and equipment for well pulling and overhaul or replacement value of corroded equipment; (*b*) indirect—value of lost production and cost of repairs in gathering lines and handling facilities. In two wells under treatment costs were reduced by $502 and $165 per month respectively.

Corrosion mitigation includes insulation between rods, well head, and casing and lead lines to reduce stray currents, and avoidance of dissimilar materials causing galvanic corrosion. The use of corrosion-resistant metals, emulsification of oil and water phases, and mechanical coatings are of some assistance.

The most effective method of corrosion prevention is by the use of chemical inhibitors. These are of three types: (*a*) neutralizers—sodium bicarbonate, soda ash, etc.; (*b*) film-forming compounds, notably the chromates; (*c*) organic inhibitors.

It is important continually to check the effectiveness of any adopted method of corrosion control, and to analyze the breakdown histories of wells. C. G. W.

1650. Detection of Incipient Drill Pipe Failures. W. C. Main. *Petrol. Engr*, 1949, **21** (9), B-36.—(See Abstract No. 1508.) C. G. W.

1651. Hydraulic Rigs Ready for Field Tests. R. Harwick. *Oil Gas J.*, 25.8.49, **48** (16), 128.—Hydraulic rigs eliminating draw-works, travelling blocks, brakes, clutches, etc., have been introduced. Cables are attached to pistons. Oil fed into the cylinder above the piston raises the load. Release of oil, and injection of compressed air below the piston lowers the load. Concentric telescoping tubes sheath the cable and eliminate the necessity for packing it. The cylinders are built into a portable mast or derrick. Power is supplied by internal-combustion engines driving centrifugal pumps.

One rig is desiged for drilling 5000–6000 ft with 4½-in drill pipe, another is designed for well servicing and will pull 7000 ft of rods. C. G. W.

1652. Drilling Practices in Iran. Part 1. H. W. Lane. *Oil Gas J.*, 4.8.49, **48** (13), 56.—Drilling and production practices are reviewed. Since hard formations are predominant, rock bits are exclusively used. Drilling speeds are low (about 1000 ft/month) due to: (*a*) pressure conditions in certain sections; (*b*) safety considerations; (*c*) servicing difficulties. Upper formations comprise marls and sandstones drilled with plain shale-water mud with or without bentonite. The next division comprise marls, thick anhydrite beds and thin limestones and give high-pressure water and gas shows. For these formations shale-base chemically treated, weighed bentonite mud is used. The lower beds are variable anhydrites, marls, salts, and limestones which tend to flow plastically. The presence of very high-pressure salt-water shows, together with mud contamination and squeezing formation, make this a difficult zone to drill.

At the base of these formations lies the cap rock—100 ft of anhydrite. The oil zone is massive porous and fractured limestone up to 1500 ft thick, with some anhydrite and marl beds. Pressures are frequently high.

Two casing programmes are in use, one where high pressures are expected. This uses "inserted-joint" casing which can be run through or packed into a well under high pressure.

Drilling is started in a 19½-in hole. 16-in casing is set between 500 and 1000 ft, a well-head with 15-in valve and Cameron gate is fitted and well drilled with 14¾-in bit to 3000–3500 ft. 11¾-in casing is cemented to surface, the well is modified for pressure drilling, and a 10⅝-in bit run to 5000–6000 ft. 8⅝-in casing is cemented in, and the hole drilled and cased to cap rock. Materials used in making up drilling muds are: bentonite–aquagel-Gelsil; hæmatite–barytes–Baroid; sodium hexametaphosphate; cellophane gel and mica; stabilite; sodium silicate; quebracho; magnesium chloride. C. G. W.

1653. Pressure Drilling in Iran. Part 2. H. W. Lane. *Oil Gas J.*, 11.8.49, **48** (14), 89.—Pressure drilling entails the imposition of a back pressure on the formation so that formation pressures in excess of that exerted by the fluid column can be balanced.

Two methods of pressure drilling are possible: (*a*) closed method. Mud returns are passed through a closed vessel where cuttings are separated. The mud pressure never falls below the control pressure; (*b*) open method. Mud returns are discharged through chokes or beans, imposing a back pressure by restricting flow.

A system of semi-pressure drilling is generally adopted to avoid snubbing drill pipe into and out of the hole. The well-head consists of a Cameron gate, a Seamark hydraulic

packer, which can shut off on drill pipe while permitting vertical movement, and a double-deck stuffing-box, which provides a shut off while drilling.

Side-line connexions above and below the Cameron gate discharge through twin cuttings separators and adjustable flow beans on to a vibrating screen and hence to slush pits.

Composite 4½-in A.P.I. full-hole flush-joint drill pipe is used, and pipe is added at surface to work through the double-deck packer in conjunction with a round kelly and overdrive. Three non-return valves are employed in drilling string, and one on mud delivery line to the well head. An automatic spider prevents drill pipe being blown out of the hole in the event of failure near the surface.

When pulling out, heavy mud is circulated to maintain pressure, and when running in, the pipe is filled with drilling gravity mud to prevent air cutting of the mud column.

When drilling in to productive formation, low-permeability mud, to give a 250 p.s.i. differential, is prepared. A reserve of viscous mud, mixed with cellophane or mica, is held in case of lost circulation.

When drilling through the gas dome, pressure drilling is employed, and viscous muds and sealing compounds held in reserve. Two main valves are fitted which remain on the well after completion. The lower valve is not used until the well is completed.

A policy of safety is adopted in all practices in the field. C. G. W.

1654. Planning, Running, and Cementing Casing Strings. N. A. Tinker, Jr. *Petrol. Engr*, July 1949, **21** (8), B-11.—For effective use of casing centralizers and scratchers, it is necessary to study beforehand the problems peculiar to their use.

The approx casing point, the approx top of the desired cement column, and the spacing of scratchers and centralizers are the first things to be determined. The approx casing point will be determined by the drilling contract and centralizer and scratcher spacing by the length of reciprocation, condition of hole, deviation from vertical, etc. Having determined the desired top of cement, the casing should be checked to ensure that it is racked properly for running. Before running casing, the procedure in progressive circulation to be adopted should be determined. It is usual to circulate at every 1000–1500 ft and at any time when the casing threatens to stick. While circulating, the casing should be reciprocated. It is important to keep circulation pressures at minimum. To determine when to stop circulating, frequent tests of mud weight and viscosity are effective.

After the final circulation period a cementing head is fitted. It is good practice to pump a bottom plug ahead of the cement slurry, thus cleaning the casing of mud. The casing should be kept in slight movement while cement is being mixed, full reciprocations being resumed when the cement is being pumped.

References are appended, and two appendices illustrate some of the necessary calculations in running and cementing casing. C. G. W.

1655. Perlite Used to Combat Lost Circulation. E. E. Barberii. *Oil Gas J.*, 28.7.49, **48** (12), 280.—Requisites of an additive for lost circulation are, incompressibility, temperature-resistant, chemically inert, and readily forming a stable seal. Perlite, a grey siliceous lava fulfils these requirements. On heating to about 2500° F perlite loses weight and a volume expansion of about 600% occurs. This has been used satisfactorily as a building-material aggregate. Laboratory tests on the material are described. C. G. W.

1656. Construction of Offshore Drilling Platforms with Large Diameter Pipe Piling. M. P. Anderson. *Petrol. Engr*, July 1949, **21** (8), B-60.—On a typical drilling platform with a live load of over 5 million lb the load is supported through floor beams and double Warren-type trusses on thirty-six piles. The piles are 30-in dia with a wall thickness of ⅝ in, length 130 ft, desired penetration 75 ft. Piles are driven from the stern of an ocean-going barge.

The lead tower is 60 ft high, and a crane for handling piles, hammer, etc., is mounted behind the lead tower. The crane has a boom 120 ft, capacity 50 tons, and a movement of 50 ft.

Boilers, generators, etc., are located below decks. The barge is anchored by four 5000-lb anchors in addition to the usual bow anchor. The barge is guided to location

by two instrument towers on shore. The hammer used weighed 9 tons, and the ram 9300 lb with striking energy 30,225 ft-lb.

The piles are broad diagonally with 1¼-in wire ropes tightened by a turn buckle. The pilings are aligned by clamping timber struts, and trusses are then set and welded in position. Horizontal truss connexions allow 2 in of horizontal adjustment to provide for misalignment. C. G. W.

1657. Economics of Shallow Drilling. K. M. Fagin. *Petrol. Engr*, July 1949, **21** (8), B-7.—Production in West Central Texas is mainly from shallow fields—500 ft—to 3500 ft. Being operated under conservation rules and efficient practices recoveries up to 500 brl/acre-ft are obtained compared with 200–250 brl/acre-ft by primary recovery methods. The relatively high per well allowable for shallow wells permits a rapid return on investment and has stimulated wildcatting and development drilling. Well and production data and approx drilling costs for some areas are tabulated. C. G. W.

1658. Sampling and Examination of Well Cuttings. J. M. Hills. *Petrol. Engr*, July 1949, **21** (8), B-40.—(See Abstract No. 537.) C. G. W.

1659. Drilling and Completing Utah's Deepest Producer. J. W. Gibson. *Oil Gas J.*, 14.7.49, **48** (10), 82.—The well was completed 8857 ft. Drilling-mud programmes and the drilling progress are described. Several fishing jobs occurred, and diamond rotary shoes were found very useful for washing over drill collars. C. G. W.

1660. W. Texas Drilling Record. R. F. Carlson. *Oil Gas J.*, 18.8.49, **48**, (15), 103.—A 16,024-ft hole was drilled in thirty-eight days in West Texas. Three drill-stem tests occupied 39 hr, 129 hr for running and cementing casing, 22 hr for fishing and lost circulation, and rigging up time brought total time to 1128 hr. Thirteen 12¼-in and sixty 8¾-in bits were used. Mud weight was increased with depth, and at 10,000 ft was 9·7 lb/U.S.G., water loss 13·6 cc, filter cake 2/32 in, pH 8·5. Viscosity was 40–45 sec.

Rig used included 136-ft 800,000-lb derrick draw-works rated for drilling to 15,000 ft with 4½-in drill pipe. Mud pumps were 7¼ × 18 in and 8 × 20 in. Power is by a 1000-hp triple engine group compounded by chain drive and air clutch. Automatic hydraulic drilling control is also incorporated. C. G. W.

1661. World's Deepest Well. R. Sneddon. *Petrol. Engr*, Aug. 1949, **21** (9), B-15.—Superior Oil Co.'s Well Pacific Creek No. 1 has reached 20,521 ft. The derrick was one of 192 ft and 1,100,000-lb capacity. 630-ton crown block and 540-ton travelling block were used. Power supplied by five diesels, two being used to drive three slush pumps. Careful mud control resulted in good footage from bits. Fluid couplings were used on the drives. Casing programme and drilling programme and the formation drilled are described. C. G. W.

Production.

1662. Chemical Treatment of Flood Water for Bacteria and Corrosion Control. J. N. Breston. *Oil Gas J.*, 25.8.49, **48** (16), 96.—Bacteria control in water-flood operations raises problems in corrosion control. Since clay-containing sands have a higher permeability to acid water than to neutral or alkaline waters, and since bacteria multiplication is inhibited in acid waters, corrosion control at low pH is desired. The search for an acid-corrosion inhibitor led to an investigation of the effects of organic amine salts. Work to date has involved the following: (1) development of test methods for screening bactericides and corrosion inhibitors for flood waters; (2) search for more effective bactericide-corrosion inhibitors; (3) determination of the chemical types with greatest bactericidal and corrosion-inhibiting qualities; (4) determination of surface-active properties of bactericide-corrosion inhibitors.

A corrosion test was devised whereby test plates are rotated in a jar containing the water and inhibitor under test. An oil blanket maintains air-free conditions, and a siphon tube permits removal of samples for pH and iron-content determinations. The test plates are then compared with plates treated similarly with a test in standard solution. Interfacial tensions between air–water and crude–water solutions of com-

pounds were determined by du Noüy tensiometer. It is concluded from these tests that alkyl and argyl amine salts and certain condensed ethylene oxide amine compounds have suitable corrosion-inhibiting and bactericidal properties for oilfield purposes. Concentrations of 10 p.p.m. are effective for corrosion control, and lower concentrations for bacteria inhibition. References are appended. C. G. W.

1663. Formation Slippage at Wilmington. R. Hardwick. *Oil Gas J.*, 18.8.49, **48** (15), 143.—Earth subsidence and strata slippage has caused some concern in the region of Long Beach, Calif. Subsidence up to 9 ft has occurred in some areas. The settling may be due to earth compaction, since the area is largely built up on reclaimed or "made" land. This view is not corroborated by oil-well evidence. A number of wells have gone off production, and a check on wells in the region showed a large number damaged by casing collapse at about 1600 ft. Failure of the casing has been demonstrated to be due to shear forces. Cores of the area show that the interval is consistently slickensided.

To protect wells the interval has been reamed to 30 in dia and the hole filled with viscous oil to which gelling agents are added. Compression points are employed in the casing string as an added precaution.

Investigations show no evidence of any movement or damage later than Feb. 1948. Evidence shows that slippage had occurred previously and that the slippage is not along fault lines, although the area is intensely faulted. C. G. W.

1664. Oil Production in Iran. H. W. Lane. *Oil Gas J.*, 18.8.49, **48** (15), 127.—Petroleum reservoirs are large anticline structures, lower Miocene to Oligocene, porosity 2–15%. The lower trap is by salt water, gas caps are usually present. Extensive fissuring gives free fluid connexion throughout the reservoirs. Observation wells are drilled in order to observe and record water, gas, and oil levels. Well production gas–oil ratios, saturation pressures, static and producing bottom-hole pressures, and reservoir temperatures are determined on all producing wells. From the information from observation and producing wells, production quotas are established for all wells.

Well spacing is determined in order to procure longest possible producing life and in higher-pressure fields by demands of surface development. The high permeability obviates the necessity of spacing for efficient drainage. In all wells acid treatment is applied, three or four treatments being necessary. Production up to 28,400 b.d. is frequently achieved.

Production systems at present follow these principles: (1) all tankage dispensed with—refinery connected to reservoir; (2) reservoir energy used instead of prime movers and pumps; (3) gas separation so that light ends are retained; (4) fully automatic production control crude passes from well-head through a flow controller to a high-pressure gas separator. It is then delivered through a graded pipeline to the central stabilization unit. Incorporated in this unit is a differential valve, which cuts off flow completely if a certain flow rate is exceeded. Five multistage stabilization units are employed. By this system butanes and pentanes are retained in the crude without absorption or compression. Atmospheric and vacuum stages can be included if desired. Horizontal-type separators are used with heat exchangers, where the incoming crude is at high temperatures. The separated gas is used for domestic and industrial purposes.

Automatic controls are such that if it is desired to vary the production of one unit, it is necessary only to regulate the flow down the main pipeline to the required throughput. The flow throughout the whole system from the well-head is then regulated to this value.

When required, products can be recycled back to the reservoir. C. G. W.

1665. Mexican Oil Fields. A. G. Rojas. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1336–1350.—Mexico's oil production comes from three main provinces that are in descending order of importance as follows: (1) Tampico–Túxpan oilfields; (2) isthmus oilfields; (3) Northeastern Mexico.

To December 31, 1947, the Tampico–Túxpan oilfields produced 2171 million brl of oil, which amounted to 94% of the total cumulative production of Mexico. The Isthmus area has produced 148 million brl, which accounts for the remaining 6%. Northeastern Mexico has not produced any commercial oil so far, but some gas-fields

have been developed there, and two commercial oil-wells have recently been discovered in that area.

It is concluded that the most important prospective areas for the discovery of new oilfields in Mexico are in the coastal plain of the Gulf of Mexico.

Detailed information is given of the drilling and production data for the various Mexican oilfields. E. N. T.

1666. Neutralizing Agents for Condensate Well Corrosion Control. D. A. Shock. *Oil Gas J.*, 11.8.49, **48** (14), 77.—It has been established that condensate well corrosion is due to acid attack by carbonic and lower organic fatty acids. The pH value of produced water is related to concentration of carbonic and acetic acids.

By passing mixtures of CO_2 and natural gas through gas scrubbers in which the electrodes of a standard pH meter are contained, pH values of CO_2 solutions at various partial pressures may be determined. The CO_2 and natural gas are passed through rotameters before mixing, and partial pressures are controlled by varying the flowrate of the gases. pH values of CO_2 in the presence of salts, sodium acetate, and neutralizing agents were determined. It is concluded that a small excess of neutralizing agent over that required to neutralize organic acids is sufficient to buffer the solution so that low pH values are not reached with partial pressures up to 1 atm.

Magnesium metal may be used effectively to neutralize acids.

pH values can be raised to 6·0 under well conditions and corrosion practically eliminated by injecting sodium carbonate. C. G. W.

1667. Oil Reserves and Secondary Recovery. E. C. Arnold. *Oil Gas J.*, 28.7.49, **48** (12), 286.—Present estimates of reserves and methods of secondary recovery are reviewed. It is pointed out that discovery of new fields, resulting in a fall of the price of crude oil, will make present secondary recovery methods uneconomical. The value of combining primary and secondary recovery and of unitized operations is emphasized. The possibility of secondary recovery by circulating gasoline and light hydrocarbons is mentioned. After oil recovery, the rich gas remaining in the sand could be recovered by circulating residue gas through a stripping plant. C. G. W.

1668. Rotary Compressors for Field Booster Service. E. O. Hinton. *Oil Gas J.*, 21.7.49, **48** (11), 71.—When additions were necessary to get flow from gathering stations to a central compressing plant skid-mounted rotary compressors coupled to natural-gas engines were adopted largely due to their portability and low cost of operating labour.

Each compressor was rated at 1,430,000 cu. ft. per day, 5 p.s.i. suction and 25 p.s.i. discharge pressures. Costs are analyzed, and total cost compared very favourably with other types of equipment.

Maintenance of plant is described, particularly experience with lubricants. Operating costs are analyzed. C. G. W.

1669. Virgin Sands in Stripper Wells. F. R. Cozzens. *Petrol. Engr*, Aug. 1949, **21** (9), B-60.—Frequently in old wells the upper portion of pay sand has been cased off, and the well not drilled to the base of the pay. Thus when the well was shot, a considerable length of pay sand remained unproductive. Procedure in reconditioning wells without knowing the marginal sand zones is to raise the casing 12–15 ft off the shoulder. The shot hole is then bailed out and drilled down to the base of the pay sand. Upper and lower margins are then shot. The hole is then cleaned to bottom and 10–15 ft of pocket drilled. If porous zone is encountered it should be sprayed with cement. The hole is then washed down and bailed. The hole is then bridged 2 ft above the original shoulder and 3–5 ft of cement set. The casing is then re-set and the cement and bridge drilled out. Another practice is to replace the inner casing with 2-in tubing run on a packer. The packers are backed with 10–20 ft of cement.

Packers or casing shoulders should be located immediately above the top of the producing sand. C. G. W.

Oilfield Development.

1670. New Petroleum Development by Petroleos Mexicanos in Northeastern Mexico. E. J. Guzman. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1351–1384.—The area under

consideration is part of the geological province of the Coastal Plain or Gulf Coast of Texas and Louisiana. The Jackson is the oldest formation reached by wells in the area. Commercial production, either oil or gas, has been established in the Jackson, Vicksburg, and Frio formations. The Anahuac formation with its three faunal zones has been identified in the downdip wells. The name Fleming is used to comprise the undifferentiated Miocene formations which overlie the Anahuac.

Approx twenty closed structures have been mapped by seismic exploration. All the structures drilled are anticlines, but the production is closely related to stratigraphic changes in permeability and thickness of the sands.

Since the beginning of drilling operations in 1944, Petroleos Mexicanos has drilled nineteen wells, resulting in the discovery of three gas-fields and one oilfield.

A number of useful stratum contour maps and sections is given. E. N. T.

Transport and Storage.

1671. Argentine Gas Line. L. M. Moloney. *Pipe Line News*, 1949, **21** (7), 8.—This 1100-mile gas pipeline will have an initial capacity of 35,300,000 cu. ft. The 10¾-in line was built in two sections to speed up construction. The northern section was completely self-contained while under construction, offices, warehouses, housing, etc., being provided by buses, trucks, and trailers which move with the line. Joints on the line were electric welded, using both rolling weld and stove-pipe methods. Welds are inspected by a magnetic method. Corrosion protection is provided by coating and wrapping, and cathodic protection is also provided. All finished sections are tested at 256 p.s.i. and at 1056 p.s.i. for periods of 24 hr. C. G. W.

1672. Corrosion. Anon. *Pipe Line News*, 1949, **21** (7), 16.—This is a bulletin prepared by the Correlating Committee on Cathodic Protection. In this bulletin the desirability of joint co-operation, in areas where two or more operators are experiencing similar corrosion problems, is emphasized. The best means of effecting a satisfactory joint system are outlined. C. G. W.

1673. Cost-imating Refinery Valves. W. L. Nelson. *Oil Gas J.*, 25.2.49, **48** (16), 143.—No. 45 in the series gives a table showing approx cost (1946) of diaphragm control and relief valves, and a chart shows plots of valve size against dollars.

Prices vary widely, approx plus or minus 40%. G. A. C.

1674. Economic Sizing of Petroleum Pipe Lines. F. C. Whiteside. *Pipe Line News*, 1949, **21** (7), 12.—Initial factors in pipeline design include estimation of peak production from all areas served by the pipeline system, estimation of demand from a new area into refinery and consumer sections, proportion of the total production that the new line is called upon to carry. In the past, pipeline systems have usually been inadequate and inefficient, but recent trends in pipeline design and operation are compelling transportation companies to improve their systems.

Economics and design of a line are concerned with: (1) length of pipe; (2) size of pipe; (3) minimum wall thickness at low-pressure end; (4) tensile strength of steel and operating safety factor; (5) price of pipe, equipment, and the cost of construction; (6) operating pressures; (7) station spacing; (8) volume viscosity and gravity of oil; (9) operating temperatures; (10) elevations along the line; (11) operating practices, costs, and desired rate of return on investment.

By standardizing and modifying some of these basic factors it is possible to present graphically a relation between line size, station spacing, and throughput, assuming a 7% rate of interest.

Points of interest derived from the studies are: (1) the existence of an optimum pressure for a given line size; (2) the fact that the sizes of lines determined by this method are greater than those in general use. C. G. W.

1675. Ozak Stations Feature Advanced Electrical Design. M. A. Hyde. *Pipe Line News*, 1949, **21** (8), 41.—The 22-in line covers a distance of 435 miles, and six pumping-stations are installed for a capacity of 187,000 b.d. The first five stations also serve a separate 10-in line, capacity 28,000 b.d. Each station contains three

1250-h.p. 1800-r.p.m. units and one 600-h.p. 1800-r.p.m. unit for the 22-in line. For the 10-in line a single 700-h.p. 3600-r.p.m. unit is installed. All main-line units operate at 4160 v. Each station contains three two-stage units to develop 240 p.s.i. giving a pressure of 720 p.s.i. for the three units in series. With suction pressure of 20 p.s.i. discharge pressure is 740 p.s.i. By combination of full-head and half-head units, throughputs lower than the designed can be accommodated. Changes in viscosity and specific gravity can also be compensated by varying station pressure.

Remote electrical controls for all phases of operation are centralized in an operating room. C. G. W.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1676. Doctor Solution Regeneration Unit. R. Harwick. *Oil Gas J.*, 1.9.49, **48** (17), 62.—A description is given of the new unit designed to regenerate doctor solution, now under construction at the Torrance, California, refinery of the General Petroleum Corporation.

Twice the normal quantity of plumbite solution will be used per unit of sour gasoline, and in the caustic prewash the cresylic acids content of the sour gasoline will be reduced to a minimum.

Reaction is carried out in a closed vessel to eliminate possible hazards of fire and foaming.

The regenerator tower is designed to provide a relatively high pressure drop of about 25 p.s.i. The design rate of the unit is 5300 b.d. of foul doctor solution.

A feature of the regenerator is easy removal and cleaning of trays. G. A. C.

Absorption and Adsorption.

1677. Propane Recovery Increased by 68 to 92 per cent. W. S. McAllister. *Oil Gas J.*, 25.8.49, **48** (16), 101.—A description of the modernized Gladewater Plant of Warren Petroleum Corp, Texas, is given.

Complete new absorption and distillation equipment was installed, refrigeration eliminated, and existing product fractionators, generating facilities, and cooling tower employed. The plant is completely instrumented for full automotive control of a widely fluctuating feed rate.

The change has resulted in raising the overall propane recovery from 68 to 92%, with a simultaneous reduction of 20% in the overall plant fuel consumption and 60% in the overall plant steam requirements. G. A. C.

Solvent Extraction and Dewaxing.

1678. Optimum Temperature Gradient in Selective Solvent Extraction. E. J. Reeves. *Industr. Engng Chem.*, 1949, **41** (7), 1490–1492.—The temp gradient in solvent extraction equilibria is shown, by mathematical analysis, to have an optimum which depends on the quantities and nature of solvent and oil used, and on the No. of extraction stages. For a tower of given eff, the most eff utilization of solvent to obtain the highest yield requires maintenance of optimum raffinate and reject temps, which can be expressed, respectively, by the equations

$$T_2 = -(r+1)/s$$
$$T_1 = -w/x.$$

T_2 and T_1 being expressed in terms of the constants r, w, x, and s. R. G. T.

1679. Separation of Hydrocarbons by Solvent Extraction—(Relation of Distillation Vapour–Liquid Extraction, and Liquid–Liquid Extraction). H. J. Hibshman. *Industr. Engng Chem.*, 1949, **41** (7), 1366–1368.—Separation selectivities, α, for distillation, β, for liq–liq extraction and γ, for vapour–liq extraction are related by thermodynamically derived equations. The relationship $\alpha \times \beta = \gamma$ is shown to be approx true for separation of components which conform approx to the perfect solution and gas laws (*e.g.*, hydrocarbons). R. G. T.

1680. Separation of Hydrocarbons by Solvent Extraction. (Separation by chemical type and Molecular Weight.) H. J. Hibshman. *Industr. Engng Chem.*, 1949, **41** (7), 1369–1374.—Calc is made of selectivities for separating hydrocarbons by vapour–liq and liq–liq extraction processes, from partial pressure data of pure hydrocarbons above a typical selective solvent, dimethyl phthalate. The boiling range of a mixture separable by a liq–liq process is shown to be *ca* three times that separable by a vapour–liq process. The selectivities for separating hydrocarbons of equal b.p. according to chem type increase with b.p. and result in extraction in the following order : saturated aromatics (*e.g.*, C_6H_6, $C_{10}H_8$, etc.), alkyl substituted aromatics, naphthenes, and paraffins. R. G. T.

Cracking.

1681. Fluid Catalyst Cracking with Silica–Magnesia. R. W. Richardson, F. B. Johnson, and L. V. Robbins, Jr. *Industr. Engng Chem.*, 1949, **41** (8), 1729–1733.—Synthetic SiO_2–MgO catalyst for fluid cat cracking has been tested in various pilot plants. Results indicate superiority to SiO_2, Al_2O_3, and natural clays, with regard to gasoline yield. The O.N. suffers, being lower than with S_1O_2–Al_2O_3 cat, C formation is unaffected. Dry gas and C_4H_{10}–C_4H_8 yields are lower. Other effects are satisfactory, *e.g.*, C burning rate, cat attrition rate and concn, and pressure build up in vessels and standpipes. Commercial use seems justified, especially as better activity maintenance would result in less cat replacement for same level of cat activity. R. G. T.

1682. Cracking of High Sulphur Stocks [Use of Steam with Natural Catalyst]. A. L. Conn and C. W. Brackin. *Industr. Engng Chem.*, 1949, **41** (8), 1717–1722.—Rapid poisoning of the catalyst in catalytic cracking of high S stocks with natural cat, results in excessively high coke and gas yields at the expense of gasoline. Steam has been successfully used to solve this problem. Loss of cat selectivity is prevented by hydration of cat prior to contact with oil. This is accomplished by admission of steam to the regenerated cat standpipe—data are presented for a 2-b.d. fluid pilot plant. A full-scale plant test is described in which large quantities of extra stripping steam are used to restore poisoned cat to previous selectivity. Rate of S poisoning is shown to be dependent upon the extent of hydration, the feed concn of S, and extent of elimination of poison by steam in the stripping section. R. G. T.

1683. Montmorillonite Cracking Catalyst Demonstration of Presence of Hydrogen Ion in Heated Filtrol Clay Catalysts. A. Grenall. *Industr. Engng Chem.*, 1949, **41** (7), 1485–1489.—A physicochemical titration method was used to establish the presence of H ion in Filtrol clay catalyst over the entire range of catalytically cracking temps. Data are presented to show that the H ion content is a linear function of the temp at which the cat is heated in air. The decomposition temp of Montmorillonite clay can be calc from this relationship. *X*-ray and differential thermal analysis shows a mean value of decomposition temp, for several different cat batches, which agrees with the above. Steam treatment has a non-linear effect on the H ion content. With increasing steam concn under isothermal conditions, an apparent equilibrium point is reached for H ion removal. At const steam conc increased cat treatment temp lowers H ion content. The effect of time of heating is investigated. H ion content is correlated with X-ray diffraction data. R. G. T.

Polymerization.

1684. Polymerization of Olefins in Presence of Dihydroxyfluoboric Acid. J. W. Brooks. *Industr. Engng Chem.*, 1949, **41** (8), 1694–1696.—The use of dihydroxyfluoboric acid is described as a cat for copolymerization of propene with *iso*pentene, propene with *iso*butene, 1-butene with *iso*butene, 2-butene with *iso*butene, and mixed *n*-butenes with *iso*butene (refinery C_4 cut), at temp of 0–40° C and pressure of 50–125 p.s.i. The products were hydrogenated, fractionated, and analyzed by infra-red absorption. Hydrogenation of the *iso*butene–propene polymer yielded a material containing 67% of a heptane cut. The heptane cut was 95% 2 : 3-dimethylpentane. The octane fraction of the hydrogenated *iso*pentene–propene copolymer was 66·4% of the total product and contained 54·8% 2-methyl-3-ethyl pentane, 42·5% 3 : 4-dimethyl hexane, and 2·7% other hydrocarbons. The octane fraction of the hydro-

genation copolymer produced from *iso*butene and 2-butene consisted entirely of trimethyl pentanes. The octane fraction of the hydrogenated *iso*butene–1-butene polymer contained 66% trimethylpentanes and 34% dimethylhexanes.

R. G. T.

1685. Patent. Phillips Petroleum Co. B.P. 613,509 of 15.12.48. Olefin polymerization. G. R. N.

Special Processes.

1686. Maintenance of Heat Transfer by Cooling Water Treatment. W. A. Hall and R. F. Weston. *Industr. Engng Chem.*, 1949, **41** (7), 1409–1492.—Evaluation of exchanger fouling in terms of throughput capacity is simply described. Results are quoted to demonstrate the applicability and usefulness of the method on fouling caused by slime deposits from the cooling water. Bacteriological, chem, physical, and fouling data are included for two systems, both with and without water treatment. The latter consisted of phenolic treatment in one case and chlorination in the other.

R. G. T.

1687. Phenolic Antioxidants for Paraffinic Materials. H. Morawetz. *Industr. Engng Chem.*, 1949, **41** (7), 1442–1447.—Evaluation is made of thirty-four phenolic compounds and two xylene–formaldehyde condensation products as antioxidants for paraffin wax at 163° C and several relations between chem structure and antioxidant eff were established. The stabilizing eff of phenolic antioxidants were improved by alkyl substitution in the *o*- and *p*-positions, and halogen substitution in the *p*-position. Bisphenols linked with CH_2-, S-, SO_2-groups. A second OH group introduced into a substituted phenol also increased antioxidant eff. Substituted resorcinol and pyrocatechol were equally effective. R. G. T.

Metering and Control.

1688. Design and Construction of a Petroleum Refinery Laboratory. C. N. Sjogren and J. M. Deal. *Industr. Engng Chem.*, 1949, **41** (8), 1657–1664.—Several aspects of design and construction of a modern petroleum refinery laboratory are presented. Laboratory design problems are dealt with in detail. Arrangement and operation are discussed with illustration of several improvements in eff, convenience, flexibility, and safety which have been made. R. G. T.

Products.

Chemistry and Physics.

1689. Electric Forces and Electronic Configuration in Carbon Compounds. K. Fajans. *Chem. Engng News*, 28.3.49, **27** (13), 900–904.—The quanticule theory of molecule structure is discussed and supported by experimental evidence. E. S. E.

1690. Bromination of Δ^1-Olefins with N-Bromosuccinimide. L. Bateman, J. I. Cunneen, and H. P. Koch. *Nature*, 1949, **164**, 242.—The reaction between N-bromosuccinimide and 1 : 5-hexadiene yields, *inter alia*, a monobromo derivative the constitution of which has been identified by ultra-violet and infra-red spectrographic analysis as 90% $CH_2{:}CHCH_2CH{:}CHCH_2Br$ and 10% $CH_2{:}CHCH_2CHBrCH{:}CH_2$. Similarly 1-octene yields 80% of $CH_3(CH_2)_4CH{:}CHCH_2Br$ and 20% of $CH_3(CH_2)_4CHBrCH{:}CH_2$, which are partially separable by fractional distillation. H. C. E.

1691. N-Bromosuccinimide as a Reagent for Bromine Addition. E. A. Braude and E. S. Waight. *Nature*, 1949, **164**, 241.—The reaction between N-bromosuccinimide (I) and *cyclo*hexene or allyl benzene gives bromine-substituted compounds; in the presence of substances such as tetraethylammonium bromide addition compounds are formed. The first reaction is rapid and is catalyzed by benzoyl peroxide, whereas the second reaction is relatively slow and is not so catalyzed. These differences can be explained by assuming that whereas the substitution reaction is a chain process

involving the homolytic fission of the N-Br bond in I, the addition reaction involves the heterolytic fission of the N-Br bond as the rate-determining step, followed by homolytic hydrogen-abstraction. H. C. E.

1692. Reaction of Diene Hydrocarbons with Nitroso Compounds. Addition of 1 : 3-Butadiene to Isomeric Nitrosotoluenes and of 1 : 3-Pentadiene and 2 : 4-Hexadiene to Nitrosobenzene. Yu. A. Arbuzov and N. L. Fedyukina. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 1173–1176.—1 : 3-Butadiene reacts with nitrosotoluenes yielding with the *ortho* isomer a product having b.p. 92–92·5° (1·5 mm) with the *meta* 99·5–100° (1·5 mm) and with the *para* m.p. 46–47°. 1 : 3-Pentadiene and nitrosobenzene yield a product with b.p. 94° (2·5 mm) and 2 : 4-hexadiene with nitrosobenzene gives a product with b.p. 94° (2 mm). All the reactions proceed in the cold. Yields were 57–81% for the products from the nitrosotoluenes and 31–38% for the products from the penta- and hexadiene. Full experimental details are given and also the structures of the addition compounds. V. B.

1693. Reaction of Diene Hydrocarbons with Nitroso Compounds. Addition of 1 : 3-Butadiene to Nitrosobenzene. Yu. A. Arbuzov. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 993–996.—1 : 3-butadiene and nitrosobenzene react smoothly (EtOH solution) in the cold to yield approx 90% of addition product having m.p. 50–51°. Product has formula $C_{10}H_{11}ON$ and has been identified as 2-phenyl-3 : 6-dihydro-*o*-oxazine. Full experimental details are given. V. B.

1694. The C–C Bond Energy in Ethylbenzene. M. Szwarc. *J. chem. Phys.*, 1949, **17**, 431–435.—The pyrolysis of ethylbenzene in the presence of excess toluene is shown to be a unimolecular process, the first stage being $C_6H_5–CH_2–CH_3 \longrightarrow C_6H_5–CH_2· + CH_3·$.

The methyl radicals are removed by reaction with toluene forming CH_4 and benzyl radicals, and the quantity of CH_4 so formed is a measure of the extent of the pyrolysis. Thermo-chemical data are reported as follows: $D(C–C)C_6H_5–C_2H_5$ is 63·2 k.cal/mol; frequency factor is $1·0 \times 10^{13}$ sec.$^{-1}$; $D(C–H)CH_4$ is 102·9 k.cal/mol.

The results of the thermal decomposition of ethylbenzene in the absence of toluene have been investigated, but it has been found unsuitable for kinetic studies because of a complicating chain reaction. W. E. M.

1695. Absorption Intensities of Ethylenes and Acetylenes in the Vacuum Ultra-violet. J. R. Platt, H. B. Klevens, and W. C. Price. *J. chem. Phys.*, 1949, **17**, 466–469.—The spectra of three octenes, *cyclo*hexene, and 2 : 3-dihydropyrane, and of octyne-1 and -2 were obtained in *n*-heptane to 1700 Å. Intensity measurements on ethylene vapour to 1550 Å. enable the contribution of the Rydberg bands to be separated from that of the continuum. W. E. M.

1696. Photochemical Mercury-Sensitization of the Oxidation of Methane. Investigation of the Intermediate Products. A. B. Nalbandyan. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 607–610.—Investigations were made with a mixture of 62% CH_4 and 38% O_2 saturated with Hg vapour at 65–70° C. Reaction temp was 400° C and pressure 46 mm, illumination was with a quartz Hg-vapour lamp. Varying flow rates of mixture through the reaction tube were used. Oxidn of CH_4 is by a chain reaction yielding CO, CO_2, and H_2O. HCHO is the main intermediate product, the amount found in the reaction products varied from 11 to 66%, decreasing with increasing time that the mixture is in the reaction vessel. Yield of CO increases with increasing contact time. A mechanism for the reaction is suggested. V. B.

1697. Condensing Action of Methylene Radicals on Ethylene. Ya. T. Eidus, N. D. Zelinskii, and N. I. Ershov. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 599–601.—Presence of CO during cat reduction of C_2H_4 by H_2 causes the hydropolymerization of C_2H_4 on the cat surface. This new reaction is initiated by CH_2 radicals arising from the reduction of CO. Even as little as 0·025% CO is sufficient to show the effect; using C_2H_4 completely freed from CO, the only reaction occurring is reduction to C_2H_6. With increase of CO concn to 6·1% there is a progressive increase in total polymerization products. There is no reaction between C_2H_4 and CO in the absence of H_2.

The polymerizing action of CO is also evident when ethylene is substituted by propylene, butylene, or *iso*butylene. V. B.

1698. Distribution of Ketones in Water–Hydrocarbon Systems. R. E. Treybal and O. J. Vondrak. *Industr. Engng Chem.*, 1949, **41** (8), 1761–1763.—The distribution of acetone and methyl ethyl ketone between water and *n*-hexane and *n*-heptane has been investigated. Equilibrium solubility curves and tie-lines are presented for the four ternary systems at 25° C. R. G. T.

1699. The Vapour Pressure, Orthobaric Liquid Density, and Critical Constants of *iso*Butane. J. A. Beattie, D. G. Edwards, and S. Marple, Jr. *J. chem. Phys.*, 1949, **17**, 576–577.—The v.p. and orthobaric liq densities of propane-2-methyl were measured from 30° to 125° C. The v.p. may be represented by the following equation:

$$\log_{10} p \text{ (normal atm)} = 4{\cdot}31269 - 1126{\cdot}71/T$$
$$\text{where } T = t^\circ \text{ C} + 273{\cdot}13.$$

The critical constants were determined by the compressibility method. They are: $t_c = 134{\cdot}98 \pm 0{\cdot}05^\circ$ C, $p_c = 36{\cdot}00 \pm 0{\cdot}05$ normal atm, $v_c = 0{\cdot}263$ litres per mol, $d_c = 3{\cdot}80$ mol per litre. The uncertainty in the critical volume and density is 2%. W. E. M.

1700. Distribution of Gaseous Solutes between Aqueous and Liquid Hydrocarbon Phases. (Carbon Dioxide.) R. C. McCay, D. H. Seeley, Jr., and F. T. Gardner. *Industr. Engng Chem.*, 1949, **41** (7), 1377–1380.—Five systems were investigated, saturated with CO_2 and each containing 5% NaCl solution and one of the following: *n*-pentane, benzene, *cyclo*hexane, decahydronaphthalene, or hexadecane. Distribution coeffs against pressure isotherms were determined for each at 40° C. An indirect procedure was employed to determine solubility of CO_2 in the aqueous and liq hydrocarbon phases. R. G. T.

1701. Distribution of Gaseous Solutes between Aqueous and Liquid Hydrocarbon Phases—(Hydrogen Sulphide). R. L. Rorschach and F. T. Gardner. *Industr. Engng Chem.*, 1949, **41** (7), 1380–1382.—Distribution coeff for H_2S between liq hydrocarbons and water were determined for the systems: C_6H_6–H_2O at 25° C, mid-Continent straight-run gasoline–water at 15°, 25°, and 35° C. and mid-Continent straight-run kerosine–water at 15°, 25°, and 35° C. Theoretical plates and water requirements for reduction of initial H_2S content from 0·5 to 0·1 and from 0·5 to 0·01 at 25° C were calc for each of the hydrocarbons mentioned. R. G. T.

1702. Heats of Adsorption and Relative Adsorbability of some Gaseous Hydrocarbons. (Silica Gel and Carbon-Black Adsorbents.) W. R. Smith and R. A. Beebe. *Industr. Engng Chem.*, 1949, **41** (7), 1431–1435.—1-butene is shown to be selectively adsorbed by SiO_2 gel from a mixture of 1-butene and butane in the vapour state. Calorimetric determination has been made of the heats of adsorption of the two hydrocarbons on SiO_2 gel—the heat of 1-butene is 3 k. cal per mol greater than that of butane in the first adsorbed layer. On C black the above heats of adsorption show little difference. Propane and butane show similar heats of adsorption on SiO_2 gel. Thus in the systems studied a correlation appears to exist between selective adsorption from a mixture of hydrocarbons and the relative vals of the heats of adsorption of the two components. R. G. T.

1703. Isomerization of Polymethylene Hydrocarbons under the Influence of Aluminium Chloride. M. B. Turova-Polyak. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 807–809.—Action of $AlCl_3$ on substituted 4-, 5-, 7-, and 8-membered cyclanes is to cause isomerization to six-membered rings, with evolution of heat, thus indicating the greater stability of the six-membered ring structure. In most cases reaction occurs at room temp, but heating increases yields, which are mainly >80%. Reaction of six-membered naphthenes with $AlCl_3$ does not occur at room temp, and even at b.p. results mainly in isomerization to another six-membered form (*e.g.*, ethyl*cyclo*hexane being converted to 1 : 3-dimethyl*cyclo*hexane). V. B.

1704. The Interpretation of the Vibrational Spectra of the C_6 Hydrocarbons 2 : 2-Dimethyl Butane, 2 : 2-Dimethyl-3-Butene, and 2 : 2-Dimethyl-3-Butyne. N. Sheppard. *J. chem. Phys.*, 1949, **17**, 455–465.—Assignments have been made for the observed I.R. and Raman frequencies. By using the frequencies previously assigned to the ethyl, vinyl, and C ≡ CH groups it is shown that the tertiary butyl group has frequencies near 1250, 1210 (2), 1025 (2), 880, and 700 cm^{-1} in the range 1350–600 cm^{-1}.
W. E. M.

1705. Volumetric Behaviour of Propene. P. S. Farrington, and B. H. Sage. *Industr. Engng Chem.*, 1949, **41** (8), 1734–1737.—Investigation is described of the volumetric behaviour of propene at temp from 40° to 460° F and pressures from 10,000 p.s.i. to less than v.p. Tabulation is made of results, and comparison with other investigators is made graphically.
R. G. T.

1706. Reacting Forms of Sulphuric Acid and its Simple Derivatives. (Note on the Theory of Sulphonation.) A. M. Lukin. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **60**, 591–594.—Theoretical. Sulphuric acid can react either as H_2SO_4 or $H_2O{\cdot}SO_3$, and its action on polycyclic ketones is discussed in this connexion. The latter form is that occurring in dilute solutions. The SO_3 portion of the mol can also show labile attachment in derivatives such as dimethylsulphate and chlorosulphonic acid.
V. B.

1707. Composition of a Synthetic Gasoline. A. Clark, A. Andrews, and H. W. Fleming. *Industr. Engng Chem.*, 1949, **41** (7), 1527–1532.—Eight fractions, obtained from gasoline synthesized from CO and H_2 with a fluidized iron catalyst of synthetic ammonia type, have been broken down, each to give four fractions of the following types: paraffins, olefins, aromatics, and oxygenated compounds. The following information on the character of the eight fractions was obtained: (1) 40–50% by vol of the C_5, C_6, and C_7 fractions consist of straight-chain 1-olefins; (2) fifteen different aromatic compounds were identified by infra-red absorption as being present in fractions 1–6; (3) small amounts of diolefins are shown to be present in most fractions.
R. G. T.

1708. Calculation of Gas Mixture Viscosities. J. W. Buddenberg and C. R. Wilke. *Industr. Engng Chem.*, 1949, **41** (7), 1345–1347.—A general equation is derived by a general correlation developed to predict the consts in the Sutherland–Thiessen equation for binary gas mixtures. The equation:

$$\mu_m = \frac{\mu_1}{1 + \frac{x_2}{x_1}\frac{1{\cdot}385\mu_1}{D_{12}\rho_1}} + \frac{\mu_2}{1 + \frac{x_1}{x_2}\frac{1{\cdot}385\mu_2}{D_{12}\rho_2}}$$

has been tested over the temp range 11–225° C with average deviation of 3·7% between calc and observed values.

A more general form to include multicomponent systems is included. Three ternary mixtures and two quaternary mixtures show an average deviation of 2·56% from the latter form.
R. G. T.

1709. Heat Capacity and Content of Tars and Pitches. D. Hyman and W. B. Kay. *Industr. Engng Chem.*, 1949, **41** (8), 1764–1768.—Determination of the heat capacities of several tars and pitches has been made using a vacuum flask in a bath of circulating air of controlled temp, the temp rise of a known weight of tar resulting from a known input of electrical energy. Tests were made on a crude water-gas tar, a pitch (m.p. 2·78° F) from water-gas tar, a crude coke-oven tar, and three coke-oven tar pitches with m.p. from 145° to 310° F. Heat capacities were measured from 100° to 600° F, the calorimeter heat capacity being determined with water and diphenyl. Heat capacity of glycerol checked with literature to 0·8%. Linear variation of heat capacity with temp were shown and correlation made by using sp. gr. or benzene-soluble fraction as a parameter. The pitches show no latent heat of fusion. Equations are derived to calc total heat content above 60° F.
R. G. T.

1710. Correction Factor for Latent Heat (Method for obtaining Haggenmacher Correction Factor without use of Critical Values). R. R. Dreisbach. *Industr. Engng Chem.*, 1949, **41** (8), 1749–1750.—A modified Antoine equation has been used to derive the Haggenmacher correction factor for latent heats. Liq densities are obtained from the law of rectilinear diameters. The b.p. and liq density are thus used instead of the crit val. R. G. T.

1711. Simple Equations for Vapour and Liquid Densities. R. R. Dreisbach and R. S. Spencer. *Industr. Engng Chem.*, 1949, **41** (7), 1363–1366.—A modified Antoine equation has been developed for calc of the orthobaric vapour density of compounds accurately to *ca* 4 atm, where only the mol. wt. and b.p. at any pressure are known. For the same range methods are developed to calc liq densities of compounds using law of rectilinear dia where b.p. at any pressure and liq densities at two temps are known. R. G. T.

Analysis and Testing.

1712. Chemistry of Gum Formation in Cracked Gasoline. E. L. Waters, M. B. Minor, and D. L. Yabroff. *Industr. Engng Chem.*, 1949, **41** (8), 1723–1729.—Measurement of rate of gum and peroxide formation in cracked gasolines and pure hydrocarbons on ageing, was made to investigate their stability. Reactive hydrocarbons and gasoline impurities (non-hydrocarbons) are thought to be the source of gasoline gum. Gum-forming products did not respond to oxidation-inhibitors as well as those forming only peroxides. The gum stability of cracked gasoline was improved by treatment, inhibition, or dilution with straight-run components. Metal catalysts reduced gum stability, but were completely inactivated by metal deactivators. Antioxidant and deactivator behaviour and the importance of boiling range of the gasoline are discussed. Antioxidants and metal catalysts were found to alter activation energies of gum-formation reactions. R. G. T.

1713. Identification of Corrosion Products (Using Measurements of Film Thickness and Mass). C. K. Eilerts. *Industr. Engng Chem.*, 1949, **41** (8), 1716–1717.—The data of Hackerman and Schmidt suggest the possibility of identification of corrosion products by measurement of the density of surface layers of the test coupons. Ability to distinguish between oxides and ferrous carbonate is suggested. R. G. T.

1714. Kinetics of the Corrosion Process in Condensate Gas Wells. N. Hackerman and H. R. Schmidt. *Industr. Engng Chem.*, 1949, **41** (8), 1712–1716.—Quantitative determinations were made of the corrosion rates of S.A.E. 1020 steel coupons exposed to the fluids of seven natural gas-condensate wells. Microscopic examination of the steel surface, and *X*-ray and diffraction methods were used. The results fit in with the corrosion classification previously proposed, viz., corrosive, mildly corrosive with less aggressive corrodent, non-corrosive even in presence of highly active corrodent.

Equations are included for the linear parts of the curves. The first two corrosion types show inverse relation between surface-layer thickness and steady reaction rate. The third type shows a change in the nature of the film, ascribed to presence of inhibitors, natural or injected, in concn sufficient for the gas production. Diffusion of corroding agent to the metal is quoted as the steady-state controlling factor, and is dependent on the nature of the surface layers. R. G. T.

1715. Ring Analysis of Petroleum Products. I. A. Musaev and G. D. Gal'pern. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1949, 1106–1115.—A crit discussion of the determination of hydrocarbon groups in high-mol.-wt. products. Sp dispersion (F and C lines of H_β) is taken as an indication of the complete hydrogenation of the material. Values $>50\cdot10^{-4}$ indicate that aromatic hydrocarbons may still be present. A nomogram is given relating sp. ref. to mol. wt. (50–700) for ten hydrocarbon types, curves also relate an. pt. of paraffin–naphthene mixtures to mol. wt., sp. ref., and H_β content. Estimation of the average No. of naphthene rings, aromatic rings, and paraffin chains can be made from a knowledge of d_4^{20}, n_D^{20}, mol. wt., and an. pt. of the hydrogenated oil and of the an. pt. prior to hydrogenation. The usual value of 0·85 is taken for multiplying the difference in an. pt. before and after hydrogenation in order to calculate aromatic rings, although evidence has been obtained that in certain cases the value

of this constant can fall to 0·45. It is assumed that ring structures occurring in pet are predominantly five and six membered. Owing to the empirical basis of the system, expression of results in terms of naphthene rings is only comparable for fractions of similar origin; when comparing oils from different crudes the results should be restricted to the average No. of rings per mol. Accuracy of mol.-wt. determinations is not vital; in the mol.-wt. range 200–230 a variation of 30 in the mol. wt. causes an error of 5·6% in the estimation of naphthene rings, and the error decreases rapidly with increasing mol. wt. (1·3% at 400–430). Calculation of naphthenic rings and No. of rings per mol. in hydrogenated material can be made either: (*a*) by determining the sp. ref. and an. pt. or (*b*) by measuring the mol. wt. and an. pt., in either case subsequently using the nomogram provided. V. B.

1716. Vapor–Liquid Equilibria of Hydrocarbon Systems above Atmospheric Pressure. E. Gelus, S. Marple, Jr., and M. E. Miller. *Industr. Engng Chem.*, 1949, **41** (8), 1757–1761.—Equilibrium vapour and liq compositions up to 500 p.s.i.g. have been obtained using a steel recirculation apparatus with automatic pressure control. Data are given for system 2 : 2 : 4-trimethyl pentane–toluene at 14·7, 29·7, and 59·7 p.s.i. Continuous fractionating columns can be tested with this system over a wide range of liq–vapour ratios. Atm pressure data are also presented for 2 : 2 : 4-trimethylpentane methyl*cyclo*hexane, useful for testing columns of high theoretical plate number.
R. G. T.

Gas.

1717. Low Temperature Recovery of Ethane from Natural Gas (Pilot Plant). R. G. Heitz, C. F. Oldershaw, W. E. Brown, and R. D. Barnard. *Industr. Engng Chem.*, 1949, **41** (7), 1540–1543.—Separation of 99% pure ethane from a natural-gas stream containing only 2·8% C_2H_6 is effected on pilot-plant scale by application of Joule–Thompson effect. Problems of operation include water and CO_2 removal, steady operation of the expansion tubing, and measurement of liq level. Water was removed by freezing and by Al_2O_3 gel, and CaC_2. CO_2 was removed by KOH scrubbing on special column. Glycerol lubrication of the compressor prevented plugging of the expansion tubing. A hot-wire electrical meter was used to determine liq level at low temp. A laboratory-size methane unit to provide refrigeration at −160° C is presented. R. G. T.

Lubricants.

1718. Steam Engine Lubrication with Oil Emulsions. G. Erber. *Mech. World*, 23.9.49, **126** (3271), 370.—Since first world war oil emulsions have found application for lubricating steam-engines especially in Germany and Russia. Following theory of water-in-oil emulsions has been advanced. When emulsion is sprayed into cylinder water nucleus of the droplets evaporates, cooling remaining oil and causing outer skin of oil to disintegrate. Actual process is certainly much more complicated, but it has been amply proved that emulsion works just as well as clean oil. Emulsions invariably consist of 50% saturated lime water, remaining 50% being made up of cylinder oils and light axle oils in varying proportions. Lime neutralizes acids in oil and forms metallic soaps, which act as emulgents. Lime is not deposited on the lubricated surfaces. Cylinder oil in the emulsion forms main lubricating medium, whereas axle or motor oil, besides lubrication, serves two purposes: it reduces viscosity of emulsion which would be higher than that of oil alone, and acts as another emulgent. Oil emulsions are not reliably stable below 30° F and above 110° F, but it is hoped to get over this difficulty by insulating the emulsion containers. Quantitatively 35–50% of oil is saved, consumption of emulsion being equal to or not more than 15% higher than clean oil. At the same time oils of lower quality can be used for emulgating.
A. S.

1719. Surface Roughness of Bearing Surfaces, and its Relation to Oil Film Thickness at Breakdown. A. Cameron. *Engineer*, 1949, **187**, 540–541.—No previous work has been published giving a correlation between surface roughness and oil-film thickness at breakdown which would enable the increase of permissible load, resulting from an improvement in the surface finish, to be calculated. A test apparatus is described

consisting of a rotating shaft and collar, to which mild-steel working faces for two Michell pads (one on either side of the collar) of varying surface finishes were keyed. The whole was enclosed in a casing through which lubricant could be pumped, and a known load could be applied to the pads. The thickness of the lubricant film was measured by electrical resistance, this film ranging in thickness from 20 to 250 μ-in. The best superfinished surfaces had a maximum roughness of 5–10 μ-in, and the best rouge hand-lapped surface 20 μ-in, with an average roughness of one-fifth these values. It was found that initial contact started when the outlet film thickness equalled three times the maximum (fifteen times the average) surface roughness, and that seizure occurred when the film thickness was double the average surface roughness. The same results held for light lubricants of varying viscosities. When the steel collars were finely finished the surfaces sometimes seized on initial contact; thus it may be possible to finish a surface too finely or incorrectly. A. C.

Bitumen, Asphalt, and Tar.

1720. Selection of Reference Densities for Bituminous Pavement Specifications. H. M. Rex. *Public Roads*, Aug. 1949, **25** (9), 197.—The term density is a much-maligned term in asphalt-paving technology. It may mean: (1) the calc sp. gr. of a theoretical voidless mass; (2) the observed sp. gr. of a test specimen of the mixture compacted in the laboratory; or (3) a calc sp. gr. based on the unit weight of uncoated aggregate consolidated by vibration. Evidence is given of the importance of defining the term clearly, so that when construction specifications for the various types of bituminous roadway surfacing are written, the density val of the end-point of compaction is easily understood. R. H.

1721. Laboratory Study of Asphalts from Native Bitumens and Bituminous Sandstones. R. L. Hubbard and K. E. Stanfield. *U.S. Bur. Min. Rep. Invest.* 4523, Aug. 1949. Pp. 22.—Fourteen straight-run asphalts were prepared from: (1) native bitumen from Rozel Pt., Utah; (2) bitumen from Athabaska sandstone; (3) bitumen from Edna, Calif., sandstone. Yields ranged from 74·5% of 27 pen asphalt from (2) to 99·5% of 271 pen from (1). Details of the properties of the fourteen asphalts are tabulated. They were further analyzed into three constituent groups and contained 21·0–30·4% asphaltenes, 29·7–48·9% oils, and 27·7–37·9% resins. Temp susceptibilities were measured by eleven factors. In general, the calc factors were similar to these reported for petroleum asphalts. The suitability of the bitumen asphalts for commercial purposes is indicated. In general, their characteristics are intermediate between asphalts from crude oils of Tampico and Kern River and similar to those from Oregon Basin crude oil. A bibliography of seventeen references is appended. G. S.

1722. Life Characteristics of Highway Studies. F. B. Farrell and H. R. Paterick. *Public Roads*, Aug. 1949, **25** (9), 189.—A comprehensive report of the analysis of service-life characteristics of primary rural highway surfaces, published in 1941 in *Public Roads*, has been supplemented. Further information and previous service-life estimates are compared with actual experience. Data, upon nearly 25,000 miles of construction and 130,000 miles of retirement up to 1946 in sixteen states, are given. Estimates of average service-lives are from four and a half years for low-type to twenty-seven years for high-type surfaces. For twelve states covered by the two reports, further service-lives were gauged from the 1941 estimates and experience up to 1937, five-year forecasts giving good agreement with actual mileages remaining in service in 1942. Greater differences were manifest in the ten-year estimates, probably due to the lag in construction during the war.

On January 1, 1946, the average ages of low, intermediate, and high-type surfaces were 10·6, 8·2, and 13·5 years respectively, and the corresponding remaining life expectancies 4·5, 7·6, and 12·0 years. Of the mileages in service in 1946, it is estimated that 94, 74, and 44% of the low, intermediate, and high-type surfaces respectively will need rebuilding by 1956.

Of 92,000 miles of retirements through 1945, 58% was resurfaced, 30% reconstructed, 10% transferred to other public agencies, and 2% abandoned. The proportion of re-surfacing of high types increased noticeably during the war. Preliminary studies show that owing to the salvage value at retirement, the average dollar investment life

exceeds the average service life of a surface on a mileage basis. In one particular state, for gravel surfaces constructed during 1920–25, the average service life of the surface was 5·6 years, and the dollar investment life 8·6 years. R. H.

1723. Vanadium in Ash from Asphalts. G. A. Fester and E. A. Martinuzzi. *Rev. Facultad Quimica Ind. y Agr.* (*Santa Fe*), 1948, **17**, 111–118.—The ash from certain natural asphalts in Argentina contains up to 28% vanadium. However, analysis of a typical ash from an installation using such asphalt as fuel showed only 4% vanadium, with smaller amounts of nickel and molybdenum. Laboratory experiments showed that by extracting the ash with sulphurous acid containing 6–7% SO_2, over 80% of the vanadium went into solution as tetravalent $VO{\cdot}SO_4$. This could then be precipitated by ferrous hydroxide at a controlled pH of 3–4 to give a complex $VO_2{\cdot}nFeO$. The latter product on drying and calcining was suitable for converting into a ferro-vanadium with more than 30% of metallic vanadium. A. C.

Special Hydrocarbon Products.

1724. New Aromatic Hydrocarbon Solvents in the Surface Coating Industry. S. Whincup. *Paint Technol.*, Aug. 1949, **14** (164), 345.—The production of aromatic hydrocarbons by the "Catarole" process is briefly discussed. Aromatics such as benzene, toluene, xylenes, and solid polycyclics such as pyrene, anthracene, etc., can be isolated in a very pure state. The higher-boiling range of aromatic distillates contain more complex isomeric mixtures, which are difficult to separate, hence carefully fractionated distillates of a well-defined boiling range are obtained. These yield powerful solvents. A table of the physical properties of the standard aromatic solvents produced in the "Catarole" process, and figures indicating their evaporation rates and v.p. characteristics are given.

The solvent power of hydrocarbons has to be assessed by the observation of a wide variety of properties and by direct comparison with other established solvents. Several graphs and tabulated data are presented.

The basic solvent thinner is white spirit, which has limited solvent power, but by careful addition of aromatics a solvent mixture of the desired properties may be obtained.

Brief notes are given on the drying of films and plasticizer extenders. D. K.

1725. Hydrocarbon Azeotropes of Toluene. R. F. Marschner and W. P. Cropper. *Industr. Engng Chem.*, 1949, **41** (7), 1357–1362.—Toluene has been shown to distil from petroleum as a series of toluene-lean azeotropes of saturated hydrocarbons, including several rare *cyclo*pentanes. Investigation included efficient fractionation of toluene concentrates, obtained by distillation of petroleum naphthas of a variety of types. 2-Methyl pentane and *cis*-1 : 3-dimethyl*cyclo*hexane were distilled with toluene to form toluene-rich azeotropes. The composition and b.p. of these azeotropes have been correlated in the manner previously developed for benzene-saturate azeotropes. Toluene shows a less broad azeotropic effect than benzene. Agreement with benzene azeotrope predictions warrants similar predictions to be made for toluene azeotropes. R. G. T.

1726. Catalytic Dehydrogenation of Ethane by Selective Oxidation. J. P. McCullough and J. S. Walton. *Industr. Engng Chem.*, 1949, **41** (7), 1455–1459.—Dehydrogenation of ethane by selective oxidation is discussed. Selective combustion of the hydrogen evolved in dehydrogenation is proposed on the basis of generally accepted theories of hydrocarbon oxidation. Oxygen is added to the ethane at several points in the cat chamber. Data show that part of the hydrogen evolved was oxidized during the formation of a small quantity of oxygenated product. The olefinic content of the product gases is increased by removal of hydrogen. Yields were obtained in excess of conventional yields from processes without oxygen. The effect of dehydrogenation on the degree of conversion and the selectivity of varying reaction conditions (% O_2 added, temp, space velocity and pressure) is described. R. G. T.

1727. Patents. Du Pont de Nemours & Co., and G. M. Whitman. B.P. 616,671 of 9.2.49. Production of *cyclo*hexenes.

N.V. Baatafsche Petroleum Mij. B.P. 617,408 of 16.2.49. Wick burners for kerosine and like liquid fuels. G. R. N.

Miscellaneous Products.

1728. The Colour of Pigment Mixtures. D. R. Duncan. *J. Oil Colour Chem. Assoc.*, 1949, **32** (349), 296.—A classification is presented of the different types of colour mixture of practical importance. The main sub-divisions of the scheme are: (1) integrated additive mixture which occurs when coloured lights are mixed; (2) average additive mixture embodying different light phenomena; (3) true substractive mixture, this incorporates effects observed with coloured transparent materials; (4) chromatic illumination occurring when coloured surfaces are illuminated by a coloured light; (5) pigment-mixture results when materials which are composed of or contain small white or coloured particles are mixed; (6) dye mixture occurs when two or more dyes are applied simultaneously or successively to a textile; (7) textile mixture results from threads of different colours being inter-woven; (8) half-tone mixture occurs when partly over-lapping dots of different colour are printed on a reflecting surface. The laws governing the colour of mixtures of pigments and pigmented compositions are explained, and their application to practical problems is discussed. Measurements of the relative values of the coeffs of scatter and adsorption of different pigments and their use in the prediction of the colour of pigments mixtures are considered, including colorimetric, spectrophotometric, and "rectilinear" methods of predicting matching compositions.

Other aspects discussed include: the range of colours obtainable from a given set of pigments, and the approximate proportions of different pigments which must be mixed in order to produce a given colour. D. K.

1729. A New Evaluation Method for Acaricides Using the Red Spider Mite. R. Melvin and H. H. Earle, Jr. *J. Econ. Ent.*, Dec. 1948, **41** (6), 901–902.—A method of testing Acaricides in which only the active forms are involved is discussed. Results obtained with thirty samples of tetraethyl pyrophosphate with this bioassay method generally agree within a few per cent with those obtained through chemical analysis. Species differences in resistance to tetraethyl pyrophosphate are shown. W. H. C.

1730. Control of Anopheles Mosquitoes with Coarse and Fine D.D.T. Sprays Applied by Airplane. C. C. Deonier, W. N. Sullivan, E. Nottingham, and A. W. Lindquist. *J. Econ. Ent.*, 1949, **42** (3), 447.—A description is given of tests carried out at De Lan, Fla., U.S.A., to compare the efficiency of fine and coarse D.D.T. sprays by aeroplanes for the control of *Anopheles* mosquitoes. The apparatus for, and micron dimensions of, the two types of spray-mists are outlined. The first and third applications were made with 0·3 lb (1·5 pints), and the second with 0·6 lb/acre of D.D.T. Both types of sprays were equally effective against adult mosquitoes, reducing populations by 98–99%. The fine spray killed adults faster than the coarse, but did not give so heavy a deposit. Rain reduces the residual effectiveness. Excellent control of larvæ was obtained. There is evidence of a residual effect in the areas that received the coarse application. Mosquitoes were held in check for around ten to fourteen days during the active breeding season. W. H. C.

1731. Failure of D.D.T. to Control House Flies. W. V. King and J. B. Gahan. *J. Econ. Ent.*, 1949, **42** (3), 405.—The failure of D.D.T. residues to control house flies, under the same conditions in which the treatments had formerly been very successful, has been discussed in many reports during 1948. No evidence has been obtained that the D.D.T. used was inferior in quality, or that the freshly applied residues on the walls of buildings were less potent. The main factor involved appears to be an increased resistance of the flies in treated buildings to D.D.T., probably due to their exposure, over one to four years. Flies obtained from seven localities in five states all showed a greater resistance to D.D.T. residues than that of two laboratory colonies not so exposed. All the flies tested were more susceptible than a special resistant colony that had been developed experimentally at Orlando. Heavy deposits 0·8 g/sq. ft. showed some repellency, but 0·2 g/sq. ft. was almost non-repellent. Heavy deposits of wettable chlordan and methyoxychlor were non-repellent or even slightly

attractive. Technical B.H.C. was slightly more repellent, and a partially refined product somewhat less repellent. W. H. C.

1732. The Residual Property of D.D.T. as Influenced by Temperature and Moisture. A. F. Burgess and H. L. Sweetman. *J. Econ. Ent.*, 1949, **42** (3), 420.—Screens treated with 5% D.D.T. in kerosine and held at 37° C in moist conditions showed a marked reduction in effectiveness against house flies over a period of thirty-nine months, while similar screens held at 23° C remained highly effective for the same period. Both high temp (37° C) and high moisture (60–75% relative humidty) produced a more rapid reduction in toxicity of D.D.T. than low temp (23° C) and low moisture (25–40% relative humidity). W. H. C.

1733. Improvement of Nozzles for Applying Concentrated Insecticides as Fine-Mist Sprays. A. H. Madden and A. W. Lindquist. *J. Econ. Ent.*, 1948, **41** (6), 919–924.—The development of improved nozzles for spraying concentrated insecticides is described. In the experiments the liq used contained 20% D.D.T., 15% pyrethrum extract (3% pyrethrins), 20% piperonyl cyclonene, 20% *cyclo*hexanone, and 25% kerosine. The effects of size of syphon tube and air vent, operating pressure and visc of the liquids were investigated. The best results against both *Musa domestica*, L., and *Anopheles quadrimaculatus*, Say., were obtained with a nozzle having a capillary tube between 0·015 and 0·025 in (inside dia). Efficiency of the equipment also increases with the size of the air vent. High and low visc liq were equally effective. There is a greater decrease in the number of particles than in their size with increasing intervals after discharge. Data obtained showed that size and number of spray particles are more important in controlling house flies than mosquitoes. Apparently the flies require a narrower range of particle size than mosquitoes. W. H. C.

1734. Effect of Temperature and Humidity on the Toxicity of Certain Insecticides. J. C. Gaines and H. A. Dean. *J. Econ. Ent.*, 1949, **42** (3), 429.—Dosage–mortality curves, over a range of temp and humidities, are given for the toxicity of calcium arsenate, C.-camphene-sulphur, 3% G.B.H.C.-5% D.D.T., and chlordan-sulphur, to laboratory-reared and field-collected boll weevils. In cage tests the toxicity of calcium arsenate remained more nearly the same under all temperatures than did the organic compounds. However, the toxicity of this material was reduced by both high temp and high humidity. These conditions had less effect on toxaphene than on the other organic compounds. High temp affected: toxaphene, appreciably; B.H.C.–D.D.T., so that dosages as much as 30 lb/acre were required for high mortality; chlordan, so that 23 lb/acre were needed for a 50% mortality. Constant temp and high humidity reduced the toxicity of calcium arsenate, 20% toxaphene and 20% chlordan. W. H. C.

1735. Certain Compounds Containing the Methylenedioxyphenyl Group as Synergists for Pyrethrum to Control Flies and Mosquitoes. H. O. Schroeder, H. A. Jones, and A. W. Lindquist. *J. Econ. Ent.*, 1948, **41** (6), 890–894.—Thirty compounds containing the methylenedioxyphenyl group have been tested as synergists for pyrethrum, in a 100 cu. ft. cabinet and a 7000 cu. ft. room. Concentrations of 10% were first used with 1% D.D.T. and 0·1% pyrethrins in *cyclo*hexanone. The more effective compounds were tested in 5% and 1% concentrations. Solutions containing 2% pyethrins and 20% synergists were used for the room tests. At the 10% concentrations, twenty compounds greatly increased the knockdown and mortality of *Anopheles quadrimaculatus*, Say. Only about half as many compounds were effective against *Musca domestica*, L. Ten of the compounds had no significant effect on either insect. Compounds effective against both insects were: piperonyl cyclonene; 4-(3 : 4-methylenedioxyphenyl)-5-ethyl-1 : 3-dioxane; 2-(3 : 4-methylenedioxyphenyl)-4 : 4-diethyl-1 : 3-dioxane; sesamin concentrate; and piperonylic acid, *n*-amyl ester. Especially effective against mosquitoes were a number of other esters of piperonylic acid, the di-*n*-butyl ester of piperonylidenemalonic acid, and 1-(3 : 4-methylenedioxyphenyl)-1-acetoxybutene-3. W. H. C.

1736. Research Yields New Plastic Uses. P. O. Powers. *Chem. Engng News*, 2.1.49, **27** (1), 12–13.—Improvements in type and applications in the plastics field during

1948 are reviewed covering ion-exchange resins, styrene copolymers, thermosetting resins, silicone resins, thermoplastic material, vinyl-chloride resins, polytrifluorochloroethylene, acrylates, and vinyl ethers. In the synthetic rubber field improved methods of low-temp polymerization have been developed. E. S. E.

1737. The Practical Evaluation of Wood Preservatives. W. A. Edwards. *Paint Technol.*, 1949, **14** (164), 351.—Protection of wood against fungi only is discussed, since the practical evaluation of wood preservatives is simpler against fungi than insects.

Toxic agents used for the treatment of wood are based either on cresote or on solutions of metal soaps in volatile solvents, usually the naphthenates of copper or zinc; but all these have certain disadvantages.

The "Graveyard Test" for evaluation of wood preservatives is mentioned, and its disadvantages discussed.

It is preferable to carry out evaluation tests under controlled conditions using a pure fungal culture. The procedure is as follows: a nutrient medium, containing malt extract and agar-agar, is prepared and sterilized. A quantity of this medium is poured into a Kolle flask. It is then inoculated with the required fungus, and placed in an incubator at 22–25° C. When the mycelium covers the whole surface of the medium, wood blocks are introduced and left for three to four months. Details of the preparation of the medium, growing of the fungus, and preparation of the wood blocks are given.

Quantitative tests may be carried out, by using a number of weak solutions of preservatives 0·1–5%; acetone is a suitable solvent. Dried wood blocks are weighed, placed in the solution in a Buchner flask (and prevented from floating); the pressure is reduced to extract air from the wood; when the vacuum is released, the blocks are thoroughly impregnated; they are then dried and weighed. A worked example illustrates the method. D. K.

Engines and Automotive Equipment.

1738. British Aircraft Industry Number. *Aeroplane*, 2.9.49, **77**. A review of Britain's aircraft industry on the occasion of the S.B.A.C. annual display at Farnborough is given. The journal reviews progress in the British aircraft industry, details being given of airframes and engines.

A similar survey is also given by *Flight*, 8.9.49, **56**. I. G. B.

1739. Bristol Proteus. Anon. *Flight*, 18.8.49, **56**, 191.—The development of this engine has now reached the stage when design and performance data are well established. The engine is a turbo-prop type having the following dimensions and data:

Length (jet pipe omitted)	113·35 in
Overall diameter	38·5 in
Weight (bare)	2,900 lb
Airscrew rotation	L.H. Tractor
Airscrew shaft	S.B.A.C. No. 6 standard
Reduction-gear ratio	0·09 : 1 or 0·084 : 1
Compressor turbine	10,000 r.p.m.
Airscrew turbine	10,700 r.p.m.
Output (sea-level, static)	3,200 s.h.p. + 800 lb thrust
Output (35,000 ft, 350 m.p.h.)	1,260 s.h.p. + 560 lb thrust
Fuel consumption (sea-level static)	0·688 lb/s.h.p/hr.
Fuel consumption (35,000 ft, 350 m.p.h., airscrew efficiency 80%)	0·510 lb/equiv. h.p/hr.

I. G. B.

1740. Godiva Single-Cylinder [Diesel] Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 209.—The CD1 engine has a continuous rating of 5½ b.h.p. at 1500 r.p.m. with a b.m.p. of 85 p.s.i. The cylinder has a 82·5 mm bore and a 105 mm stroke. Specific fuel consumption falls to 0·425 lb per b.h.p.hr. at 1500 r.p.m.

The piston is of Al-alloy with three pressure rings and one oil-control ring, and has flat crown. C.A.V. or Bryce injection equipment can be used, and the engine is lubricated by a valveless plunger pump. The dry weight of the engine alone is 450 lb.
H. C. E.

1741. High-Speed [Diesel] Engine from Wolverhampton Works. Anon. *Gas Oil Pwr*, 1949, **44**, 208.—The 6DT970 Meadows engine is a six-cylinder 15·9-litre four-stroke model with a top output of 180 b.h.p. at 1650 r.p.m. The cylinder dimensions are 150 by 150 mm, and the firing order is 1-5-3-6-2-4. An open-type toroidal combustion chamber is used, and the C.R. is 16 : 1. There are two inlet and two exhaust valves per cylinder.

Wet-sump lubrication is provided from a sump of capacity 6 gal. The dry weight of the engine is 3500 lb.
H. C. E.

1742. Petter-Fielding Twin [Diesel Engine]. Anon. *Gas Oil Pwr*, 1949, **44**, 207.—The FH2 twin-cylinder engine is a horizontal model having cylinders of bore 8¼ in and stroke 13¾ in and developing up to 80 b.h.p. at 500 r.p.m. The combustion pressure is 450 p.s.i. and the exhaust temperature is 800° F. Specific fuel consumption has an optimum value of 0·375 lb per b.h.p.hr. at 64–72 b.h.p. Injection is by Bryce fuel-pump through multi-holed nozzles, and a gear-type lub.-oil pump is used. Details of engine construction are given.
H. C. E.

1743. Powerful Flat-Twin Four-Stroke Diesel Engine. Anon. *Gas Oil Pwr*, 1949, **44**, 222.—This Saurer SBD model horizontal engine has cylinders 160 by 200 mm and a total swept volume of 48 litres. On continuous rating the naturally aspirated and pressure-charged models develop 10 and 13½ b.h.p. per litre respectively at a top speed of 1400 r.p.m. The specific oil consumption is 165 g per b.h.p.hr.

Injection is by Saurer multi-hole injection nozzle into a dual-turbulance combustion chamber. Lubrication is by a twin gear-type pump, and the oil circulates through a heat exchanger and filter into the end roller-bearing front cover, thence through the crankshaft and outward to each main bearing.

Characteristic performance curves of the engine are given.
H. C. E.

1744. Shell-Ricardo Lubricating Oil Test Engine. Anon. *Engineer*, 1949, **188**, 259–260.—The Shell Group and Ricardo & Co. Eng. (1927), Ltd., have co-operated under the ægis of the Engine Tests of Lubricants Panel of the I.P., in the design and manfacture of a British test engine which will suitably rate modern heavy duty lub. oils, thus obviating the difficulties in Britain of carrying out U.S. Army and Navy tests on American test engines. Details are given of the design specification for a crankcase–crankshaft assembly to which various types of cylinder can be bolted. Provision is made for two distinct lub.-oil circuits, one supplying valve cams and timing-gears with straight mineral oil, and the other supplying test oil to the rest of the engine ; these circuits are isolated from each other by oil seals along the crankshaft. Two engines have been manufactured, and one has satisfactorily completed a 100-hr type test at 1600 r.p.m. and 83 p.s.i. b.m.e.p. using a direct-injection combustion system.
A. C.

1745. The Boeing 200 h.p. Gas Turbine and the Light Aeroplane. S. D. Hage. *Aero. Engng Review*, July 1949, **8**, 30.—Performance and design details are given of this engine which has possible applications in light-aeroplane propulsion. The gas producer has a speed of 36,000 r.p.m. and drives the accessories. The power turbine runs at 24,000 r.p.m. and has a 9·6 : 1 reduction gear. The weight of the engine without accessories is approx 150 lb with a specific fuel consumption between 1·5 and 1 lb per b.h.p.hr.
I. G. B.

1746. Ruston Open Cycle Gas Turbine. Anon. *Motor Ship*, Sept. 1949, **30**, 225.—Messrs. Ruston & Hornsby have constructed a 750 kW set with a thermal efficiency of 24% for installation running at their Lincoln works, and the article contains fairly full details of the design and performance data for the plant.
I. G. B.

1747. The Dart Turbine for Civil and Military Use. Anon. *Aeroplane*, 9.9.49, **77**, 361.—3500 hr of development running have been accumulated on the Dart airscrew turbine, and the article describes the performance of this engine giving a cutaway drawing of its detailed construction. The max output is 1400 s.h.p. plus 350 lb jet thrust. The fuel consumption is 0·84 lb per s.h.p. hr. I. G. B.

1748. The Development of Turbine Engines in France. Anon. *Civic. Engng*, Aug. 1949, **29**, 244.—An account is given of some of the experimental work carried out by the research departments of Société Rateau at La Courneuve. I. G. B.

Miscellaneous.

1749. Borers from Without. Anon. *Chem. Ind.*, Aug. 1949, **65** (1), 193.—Investigations have been in hand for some time at the Bureau of Entomology and Plant Quarantine in America, to discover an insecticide formulation which will prevent wood-boring insects from damaging green timber before it is processed at the mill.

Many different formulations have been evaluated, and of these a solution of 4·66 lb of 36% γ-B.H.C. in 50 gal of fuel oil has given the best results. In general, emulsions are inferior to oil solutions for this application.

Since aqueous suspensions of micro-fine sulphur are compatible with combinations of D.D.T. or B.H.C. with sodium pentachlorphenate, wood-borers and sap stain can be controlled by a single treatment. O. M.

1750. Cost-imating Fittings and Flanges. W. L. Nelson. *Oil Gas J.*, 1.9.49, **48** (17), 71.—No. 46 in the series gives tables showing approximate cost (1946) of flanges, unions, elbows, and tees, for various sizes in cast iron (screwed and flanged), alloy cast steel (flanged), and forged carbon steel (screwed), etc. G. A. C.

1751. Dermatitis Among the Public from New Fabrics and Finishes. L. Schwartz. *Chem. Engng News*, 9.5.49, **27** (19), 1358–1360.—The principal causes of dermatitis from wearing apparel made of natural or synthetic fabrics have been the dyes, mordants and finishes. Dyes on fabrics are rarely primary skin irritants, but when this occurs the dyes bleed. Bleeding may be occasioned by acid or alkaline perspiration or oily skin. Fabric finishes are more frequently the cause of dermatitis than the dyes, *e.g.*, non-crease finishes imparted by modified natural or synthetic resins and incomplete curing of the resins. In water-proofing no cases have been encountered from insoluble metallic soaps, but Japan wax when used instead of paraffin as a waterproofing agent has caused dermatitis. Flameproofing finishes and delustering agents—no cases of dermatitis reported from users of fabrics so treated. Mothproofing—silicofluorides may cause dermatitis. Lousicides, synthetic insecticides are usually primary irritants in strong concn and may be sensitizers. The natural insecticides are sensitizers, but not primary irritants. Anti-mildews and mildewproofed material should not be worn next to the skin. Diagnosis and test methods are discussed. E. S. E.

1752. Synthetic Detergents Present Sewage Problem. Staff Report. *Chem. Engng News*, 13.6.49, **27** (24), 1723.—At the national meeting of the American Water Works Association trouble in sewage-disposal plants attributable to the use of synthetic detergents industrially and domestically was discussed. No solution to the problem had been found as yet. Propagation of bacterial growths in filters and ion-exchanger beds was also discussed. E. S. E.

BOOK REVIEWS.

Alcohol. S. J. W. Pleeth. London: Chapman & Hall Ltd., 1949. Pp. xv + 259. 28*s*.

Although fuels of petroleum origin are generally regarded as essential for internal-combustion engines, the part played by non-petroleum fuels is of importance, and the author of this book presents some of the large amount of available data relating to the use of alcohol in this connexion.

After dealing with the production of alcohols from a variety of raw materials and describing the principles of the internal-combustion engine, the effects of volatility on startability, warm up, and vapour lock are discussed. In this section data relating to tests showing how the adverse effect of alcohol on power output in the engine warm-up period is overcome by the use of casinghead gasoline and benzole are of special interest.

The section of the book dealing with knock rating and engine tests is informative to those not closely connected with the subject, but in some respects the information given is a little out of date. The CFR test method designated as L.3, which is described, is only one of many suggested alternatives to the Motor and Research Methods of test which have been discarded. With regard to reference fuels for fuel rating, the sub-standard fuels mentioned are now not used to any extent, and the use of substantially pure octane and heptane is fairly general, as the present cost is only about one-tenth of the £5 per gallon quoted, which obtained some years ago.

The author rather gives the impression that road tests are not to be relied on, but the variables affecting the road performance of fuels are now fairly well understood, and road ratings using modern techniques show a very good degree of repeatability. The performance of fuels on the road is after all the important point, and the anti-knock requirement to satisfy any proportion of vehicles in use can now be determined with fair accuracy.

The limitations of the use of alcohol in aviation fuels are discussed, and extensive data are presented in connexion with the problems of cylinder wear and corrosion in which the effects of alcohol are dealt with.

Chapters are also devoted to a survey of test methods for alcohol and alcohol blends and to a survey of world literature on the subject of alcohol fuels.

Concise summaries and extensive references to each chapter are a useful feature of the book which should provide much information to anyone interested in the practical possibilities and the economics of alcohol as a fuel for internal-combustion engines.

C. H. S.

Paint and Varnish Technology. Edited by W. Von Fischer. New York: Reinhold Publishing Corporation, 1948. Pp. vii + 509. 48*s*.

The preface to this book suggests that its genesis lay in an assembly of lecture notes used at the Case Institute of Technology, Cleveland, Ohio, where courses in classroom and laboratory are given in paint and varnish technology. The result is a composite work from thirty-three authors, mostly technicians employed with well-known firms.

The coverage attempted is extremely wide for a mere 500 pages, ranging from survey of raw materials for both pigments and media (200 pages) to principles of formulation, methods of appreciation, and testing, and in appropriate sections, such as the chapters dealing with resins of various kinds, there is a good deal of chemistry.

The book as a whole is easily read, but the informed reader, on reflection, will see its weaknesses which mostly arise from the disproportionate treatment of the various sections leading to that lack of balance which seems to be the common lot of collective works. The chapters dealing with the important aspects of pigment manufacture and varnish manufacture might have been carried further with advantage, whilst the chapter on water paints is frankly poor. By the same standards it could be said that the chapters dealing with the chemistry of urea and melamine resins and the volatiles in nitrocellulose lacquers are given space beyond their relative importance. The sections on formulation, application, and plant are generally

of a higher technical standard than the average, and the technologist will find interesting and perhaps new information. Electrostatic coating and detearing are particularly well presented, and the illustrations and diagrams emphasize the absence of these from other sections where they would have been valuable. The student with horizon necessarily limited by a syllabus will find the scope of the work adequate; the technologist will find much of interest; the researcher will be disappointed with certain aspects and the limited bibliography. As, however, the book has been written for students, one cannot complain that the treatment is wide rather than thorough, although even the student might profit from a more general treatment of the fundamentals of the subject. L. A. J.

The Petroleum Chemicals Industry. R. F. Goldstein. London: E. & F. N. Spon Ltd., 1949. Pp. xiii + 499. 63*s*.

This excellent survey of the chemical industry which has been built up from petroleum raw materials in the last quarter of a century is at once comprehensive and readable. It does not attempt to be encyclopædic, and many subjects are not, of course, treated in great detail; if they had been the book would have been many times its present size and much less readable.

What the author has done is to outline and correlate the principal types of petroleum chemicals and the ways in which they are obtained, with a strong and consistent emphasis on the underlying thermodynamic considerations which are so important to a proper understanding of the subject. The ten-page introduction, which summarizes the thermodynamic concepts used in the discussion, is both useful and appropriate.

Following the Introduction, the first fourteen chapters discuss the sources, manufacture, and chemical reactions of the various classes of hydrocarbons. Paraffins, olefins, diolefins, naphthenes, and aromatics are dealt with in turn, with good discussions of the oxidation and nitration of paraffins and of the hydration and oxidation of olefins and their reaction with halogens. Chapter 14, on acetylene, occupies thirty-seven pages, and contains an excellent account of the work of Reppe on this subject.

The last six chapters discuss aldehydes, ketones, acids and esters, olefin oxides, nitriles and amines, and chemical by-products from petroleum refining respectively. The last-mentioned class of product might with advantage have been dealt with a little more fully.

The appendices contain a number of useful charts and tables, in addition to those which occur in the text. The flow charts and reaction charts are well done. There are about 600 references to papers and important patents. The reviewer has noticed singularly few misprints.

Dr Goldstein has produced a very valuable book on a subject of rapidly growing importance. It can be confidently recommended to anyone who wishes to obtain a comprehensive and well-balanced picture of an important new industry.

E. B. E.

BOOKS RECEIVED.

The Petroleum Data Book. H. J. Struth, editor, and J. P. Love, assistant editor. 2nd edition. Dallas, Texas: The Petroleum Engineer Publishing Co., 1948. $17.00 ($15.00 in U.S.A.).

In fourteen chapters this publication contains a mass of information relating to the petroleum industry. While the mass of the data relates to the United States, there is also included some statistics and maps relating to other countries. The chapters are: International Petroleum (50 pp.); Highlights and Basic Statistics (90 pp.); Exploration and Development (94 pp.); Drilling (84 pp.); Production of Petroleum (132 pp.); Petroleum Refining (178 pp.); Gas Processing (46 pp.); Transportation (132 pp.); Marketing and Utilization (102 pp.); Investment and Finance (24 pp.); Taxation (20 pp.); Employment and Safety (14 pp.); Directories (5 pp.); Bibliography of Petroleum Literature (3 pp.).

Oil and Petroleum Year Book 1949. Compiled by Walter E. Skinner. London: W. E. Skinner, 1949. Pp. 252 + 116. 15*s*.

Contains operating and financial details, with particulars of directorate, etc., of 733 companies engaged in the oil industry.

Bibliography of North American Geology 1946 and 1947. Emma Mertins Thom, Marjorie Hooker, and Ruth Reece Dunaven. U.S. Geological Survey Bull. 958. Washington, D.C.: U.S. Govt. Printing Office, 1949. Pp. 658. $1.50.

This bibliography of North American geology, including paleontology, petrology, and mineralogy, covers the North American Continent and adjacent islands, Panama, the Hawaiian Islands, and Guam Island.

Transactions of the Institute of Marine Engineers. Vol. LX, 1948–9. London: The Institute, 1949. Pp. 270.

Included in this volume are "The Burning of Boiler Fuel in Diesel Engines," by John Lamb; and "Sea-water Contamination of Boiler Fuel and Its Effects," by Engr. Rear-Admiral C. J. Gray and W. Killner.

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Oilfield Exploration and Exploitation.

Geology.

1753. Active-surface Catalysts in Formation of Petroleum—II. B. T. Brooks. *Bull. Amer. Ass. Pet. Geol.*, 1949, **33**, 1600–1612.—In a previous paper the author presented evidence to account for the changes in the composition of crude oils with age and depth, by the action of active-surface catalysts. In 1934, D. C. Barton published graphs based on United States Bureau of Mines analyses of petroleums from Gulf Coast fields. Barton's maps for the Gulf Coast Miocene, Oligocene, and Eocene oils indicated progressive lighter constituents and less heavy residue. Barton's graphs did not show points corresponding with the composition of the oils considered in preparing the graphs. In the present paper analyses of Gulf Coast oils are plotted, including the composition of oils discovered since Barton's work in 1934, together with many produced at depths not yet reached at that time. The results shown in the present paper disclose that the regularity in change with age and depth is not as uniform as was indicated by Barton's graphs. However, although many irregularities are evident, the average results show a general tendency which is in agreement with Barton's conclusions.

The facts presented are consistent with the low-temperature history of petroleum formation as shown by other chemical considerations and geological evidence. They are not inconsistent with the formation of petroleums through the action of active-surface catalysts at relatively low temperatures, acting on the original organic source material and progressively on the heavy bitumens which are probably intermediate products. E. N. T.

1754. Devonian and Mississippian Stratigraphy, Wapiti Lake Area, British Columbia, Canada. L. R. Laudon, E. Deidrick, E. Grey, W. B. Hamilton, P. J. Lewis, W. McBee, A. C. Spreng, and R. Stoneburner. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1502–1552.—This paper describes the geologic research carried out in the northwest of Canada in the summer of 1947 under the auspices of the Universities of Kansas and Winsconsin.

Wapiti Lake lies in the folded, thrust-faulted eastern edge of the Palæozoic rocks in British Columbia, approximately 90 miles southeast of the Peace River.

Cambrian, Devonian, Mississippian, and Triassic rocks were identified in the area, but only Devonian and Mississippian rocks were studied in detail.

The Devonian section consists of: the Fairholme shale, 350 ft thick (base not exposed); the Palliser limestone, 1005 ft thick; and the Exshaw shale, 57 ft thick. Coral-reed limestones suggesting possible oil-reservoir rocks are well developed in the central part of the Palliser formation.

Three formations of Mississippian age were recognized. The Banff formation, 690 ft thick, Kinderhook in age, contains black shale at the base followed by nodular, shaly, fossiliferous limestone. There follows 1170 ft of massive, grey limestone beds alternating with zones of black, shaly limestone. These beds are correlated with the lower part of the Mission Canyon formation of Montana. A new formation name, Dessa Dawn, is proposed for them.

The 510-ft-thick Rundle formation consists of soft, brown, porous dolomite alternating with grey, hard dolomite and resting unconformably on the underlying beds. The soft, brown, porous dolomites near the base of the Rundle offer excellent possibilities as oil-reservoir rocks.

A number of interesting structural photographs and detailed stratigraphs and sections are presented. E. N. T.

1755. Geology and Petroleum Exploration in Magallanes Province, Chile. C. R. Thomas. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1553–1578.—In 1925 the search for oil in the southernmost province of Chile was taken over by the Government, and up to 1942 seven tests were drilled which found good showings of oil and gas in two different zones and in three different localities. In 1942, the search for oil was taken over by the Corporacion de Fomento de la Produccion, and since that time one oilfield has been found. A wildcat has also found a thickness of oil-saturated sand in the same zone.

The oldest sediments penetrated are probably Jurassic in age. About 6600 m of Upper Cretaceous and 5000 m of Tertiary rocks, all of which are marine sediments, have been measured. About 2000 m of non-marine Tertiary deposits overly the marine sediments. Much of this territory is covered by a fluvio-glacial blanket.

The principal sedimentary feature is the Magallanes basin. Four major and several minor unconformities have been recognized in this territory.

In view of the great thickness of marine sediments and the results to date, the possibilities of finding further oil deposits in this area appear good. E. N. T.

1756. Search for Oil by Hydrochemical Methods. M. S. Kaveev. *Doklad. Akad Nauk S.S.S.R.*, 1948, **61**, 329–331.—Underground waters in contact with oil undergo changes in chemical composition, principally an increase in the Mg/Ca ratio and in the content of CO_2 and CH_4. Analyses are given of various fresh waters from Tataria, and it is suggested that such data may be one of the indications serving to locate petroleum deposits. V. B.

Geophysics and Geochemical Prospecting.

1757. Interpretations of Foothills Structures, Alberta, Canada. T. A. Link. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1475–1501.—Geophysical exploration in the Foothills area of Alberta has provided much information about the nature of the structural conditions above and beneath major sole faults in this area.

Several examples of structures mapped and drilled are given in this paper, together with a hypothetical case wherein the difficulties of interpretations are discussed. The structures described are Turner Valley, Highwood uplift, Jumping Pound, Brazeau uplift, Stolberg, Savannah Creek, and the hypothetical Alpha structure.

It is concluded that the structural geology of the foothills of western Canada is complicated and far from being completely understood. E. N. T.

Drilling.

1758. Large Dual-Fuel Drilling Rig. Anon. *Gas Oil Pwr*, 1949, **44**, 245.—The power required for drilling the world's deepest oil-well (20,000 ft in June 1949) at Rock Springs, Wyoming, is provided by five engines arranged in groups of three and two. Each engine has eight cylinders of dimensions 8½ by 10½ in. With Büchi-type exhaust gas turbo-charger the top output of each engine is 670 b.h.p. at 900 r.p.m.

Mechanical features of the rig include: (1) micromatic drilling control, which accurately maintains the desired weight on the bit; (2) shaft drive from the draw-works to the rotary machine; (3) hydraulic couplings between engine and draw-works and pumps, thus avoiding twist-off when the torque increases due to cave-ins, etc. H. C. E.

Oilfield Development.

1759. Brazilian Oil Fields and Oil-Shale Reserves. S. F. Abreu. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1590–1599.—The best potential oil area in Brazil is the Amazon Valley, which covers 500,000 sq miles. The Maranhao Basin, which occurs in the states of Maranhao Piani, and Goias, is now being intensively investigated by the Conselho Nacional do Petroleo. A test well was recently spudded in Sergipe. In Sao Paulo six wells were drilled through Irati beds, finding oil but not in commercial quantity. In Bahia development of the Candeia and Don Joao fields is in progress; the total production of Bahia in 1948 reached 143,405 brl, and total reserves were estimated at 17·8 million brl. Oil is being distilled from oil shales in the Tertiary Paraiba Valley and the Gondwana series of southern Brazil. Bituminous sandstones containing 8–14% bitumen occur in Sao Paulo not far from the railroads. The development of the oil-shale industry depends on economic factors determined by local conditions. E. N. T.

1760. Manantiales Field, Magallanes Province, Chile. C. R. Thomas. *Bull. Amer. Ass. Petrol. Geol.*, 1949, **33**, 1579–1589.—In the southernmost province of Chile the discovery well, located on a seismic high, found oil in December 1945. It was known

as Springhill No. 1, but the name of the field was later changed to Cerro de los Manantiales.

About 1000 m of the Serie Tobifera, 10–35 m of the Springhill formation, 750 m of Upper Cretaceous rocks, and about 1500 m of Tertiary and Quaternary rocks are present in this locality.

Some small faults are present.

The oil is good quality, about 42° Bé. Due to lack of storage, no lengthy tests have been made, but most of the oil-wells have produced 25–35 brl per hour on ¼-in choke.

Isopachyte, seismic, and subsurface structure maps of the area are given.

E. N. T.

Transport and Storage.

1761. Mitigation of Corrosion of Bare Pipe Lines by Application of Magnesium Anodes. R. L. Bullock. *Oil Gas J.*, 6.10.49, **48** (22), 267.—A new method of protection of old, bare pipelines by mass installation of 7000 magnesium anodes for cathodic protection being used by the Interstate Oil Pipe Line Co., Tulsa, is described.

Corrosive areas were located, and magnesium anodes installed. These were also installed at all new leaks as they occurred.

The packaged anode consisted of 17 lb of magnesium and 27 lb of especially prepared quick-setting back-fill material packed in sacks ready for installation.

The anodes were placed 2–6 ft from the pipeline and as deep as practical, and connecting wire welded to the pipe.

Over a period of eight months the total number of corrosion leaks indicated that the method is successful and that an appreciable reduction in leaks can be expected in the future.

G. A. C.

1762. Cost-imating—Piping. W. L. Nelson. *Oil Gas J.*, 15.9.49, **48** (19), 137.—No. 48 in the series gives a formula for determining labour and installation costs of piping, and a table shows relation of piping cost to major-process-equipment cost.

It is pointed out that detailed estimates of piping costs are expensive and difficult to make.

G. A. C.

1763. Methods for Attaining High Natural Gas Throughput by Maintaining Clean Pipelines. D. K. Stephens. *Oil Gas J.*, 6.10.49, **48** (22), 225.—Clean conditions are necessary in pipelines to ensure operation at designed efficiency. Blowing alone cannot ensure complete cleansing.

An expansible fluid-actuated pipe-cleaning apparatus is described, consisting essentially of an expansible rubber core which presses a series of brushes against the pipe wall and is built like a tyre casing. It is capable of expanding 1½ in from its collapsed size, and when run at 10–45 p.s.i. there is no injury to the core.

The increased efficiency of this type of cleaner over the fixed-brush type lies in its expansibility, and in its capacity to negotiate bends of 10 ft radius.

It is stated that in cleaning 8 miles of new 26-in pipe, from 1500 to 6000 lb of mill-scale will be removed, depending on make of pipe.

G. A. C.

1764. The Roughness Problem. O. Wolfe. *Oil Gas J.*, 6.10.49, **48** (22), 189.—The flow equation, and its direct solution for pressure drop, flow rate, or dia, is discussed with respect to flow through commercial steel pipe.

An example problem is provided, and from the data are deduced pressure drop for a specified flow rate corresponding to a given pressure drop and pipe dia for a given capacity over a certain length of time.

G. A. C.

1765. How Thick Should Line Pipe Be? B. Miller. *Oil Gas J.*, 6.10.49, **48** (22), 240.—The author states that pipes are too thick, and hence waste both steel and money.

Factors which should be considered in determining the thickness of pipes are discussed, and include stresses due to internal pressure, external loads, highest safe loop-extension, and allowances for uncertainties; with recommendation for action.

G. A. C.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1766. Cost-imating—Chemical Equipment—2. W. L. Nelson. *Oil Gas J.*, 8.9.49, **48** (18), 107.—The approx installed cost (1946) is given in tabulations for the following :—

Centrifugal separators : (*a*) suspended basket ; (*b*) Bird solid bowl of steel, and stainless steel ; (*c*) Sharples-super, of D stainless steel, when driven by 2, 4, 7, 10, 20, 40, 70, 100, and 200 h.p.

Cyclone separators of 4, 7, 10, 20, 40, 70, and 100 in dia of steel and stainless steel.

Agitated vessels, tanks of ten capacities from 100 to 20,000 gal of steel and stainless steel.

Autoclaves, steel, 400, 700, 1000, and 2000 gal ; stainless steel, six capacities from 100 to 2000 gal ; glass-lined, seven sizes 100–4000 gal.

Packed Towers of 6, 12, 24, 36, 84, 108, 240 in dia of steel, Haveg, copper, stainless and glass-lined, and silver-lined, both of 24, 36, and 60 in dia.

Bubble-cap towers of steel, copper, and stainless steel, of above seven dia.

W. H. C.

1767. Cost-imating—Chemical Equipment—3. W. L. Nelson. *Oil Gas J.*, 6.10.49, **48** (22), 343.—No. 51 in the series gives tables showing approximate installed costs (dollars, 1946) of water-treating (demineralization) plant continuous thickeners (single and two compartment), tubular furnaces and Dowtherm units, and gas-holders and producers.

An index of petrochemical cost-imating is also provided. G. A. C.

1768. Cost-imating—Coil in Box Equipment. W. L. Nelson. *Oil Gas J.*, 29.9.49, **48** (21), 91.—No. 50 in the series gives tables showing approx costs of coil-in-box equipment including flanged cast-iron pipe and fittings, bends, extra heavy steel pipe headers, and standard branches.

Examples are worked out. G. A. C.

1769. Cost-imating—Vacuum Equipment. W. L. Nelson. *Oil Gas J.*, 22.9.49, **48** (20), 299.—No. 49 in this series gives tables showing approximate costs (1946) in dollars of barometric condensers, two-stage steam-jet ejectors with barometric intercondenser, and of vacuum pumps. Cost of electrical operation of some pumps less than cost of steam for ejectors, but maintenance costs usually make operating cost larger.

G. A. C.

1770. Flexibility and Efficiency Feature Tide Water Associated Filter Plant. G. Weber. *Oil Gas J.*, 8.9.49, **48** (18), 67.—The clay-filter percolation plant of the Tide Water Associated Oil Co., at Bayonne, New Jersey, is described. In the design the best features of Mississippi installations were adopted, and to minimize risks to equipment and operators a departure from normal practice was made by planning an open-air installation, which also resulted in a lower investment cost.

The plant consists of twenty-four 1800-cu.-ft.- and twenty 1600-cu.-ft.-capacity filters, operating at 150 and 30 p.s.i. respectively. Their line-up, fittings, cone angles, clay-retention construction, operation, filter cycles, storage facilities, and steam-stills for naphtha removal are described. There are three Herreshof burners to regenerate 350 tons per day which with their elevators and conveyors, and clay cycle, are described.

The plant processes up to 50 tons per day wax, 2000 b.d. neutral and 1800 b.d. bright stocks. Processing in the 30 p.s.i. filters, of the following, are described :—

> Four grades of Penn. neutral oils from 150 to 190 sec S.S.U. visc at 100° F.
>
> Several grades Mid-Continent-type solvent-extracted neutral oils from 70–100 to heartcut grades of 400–1000 sec visc at 100° F and several tailor-made oils, in the same range of visc, varying in colour and V.I.

Bright stocks are filtered in the 150-p.s.i. filters. Ten are used for filtering at 140–150° F Penn. undewaxed bright stocks in 60% naphtha, and after centrifugal dewaxing and naphtha removal, produce 150 sec S.S.U. visc products at 210° F. Bright stocks

for aviation lubricating oils are further refined by solvent-extraction, prior to filtration, as described above. Eight units are employed for filtering dewaxed bright stocks, without naphtha, at 250° F giving finished specification oils.

Wax from either M.E.K. solvent-dewaxing or from wax presses is sweated, and then melted prior to percolation through three of the units at 140° F. 30–60-mesh clay being used. W. H. C.

1771. Heat Exchanger. Anon. *Ingenieur*, 30.9.49, No. 39, p. 61.—Under the heading "Short Technical News" a description is given of a rather novel heat exchanger. The unit in question consists basically of a number of cooling "plates" mounted on a central tube through which the cooling medium is conducted. By rotating this tube about its axis a specific number of ports come into alignment with corresponding ports in the "plate bundle," and it is thereby possible to vary the number of plates through which the cooling-water can flow. When used as a dephlegmator this unit facilitates superior control of operating conditions. R. R.

1772. Film Coefficient of Condensing Vapour. J. C. Chu, R. K. Flitcraft, and M. R. Holeman. *Industr. Engng Chem.*, 1949, **41** (8), 1789–1794.—A modified method of measuring the H.T.C. of condensing vapour on a single horizontal tube, based on a rigorous theoretical analysis is presented. Advantages are: (1) Use of thermocouples in the tube wall, disturbing the flow of heat and fluid film, is avoided. (2) The proposed modification of the method of Wilson is based on following equations:—

$$L_0 = C_4 q^{0.333}$$

$$\frac{1}{U_0 A_0} = \frac{1}{L_0 A_s} + \frac{X}{K A_{av}} + \frac{D^{0.2}}{A 150(1 + 0.0011t) V^{0.8}}$$

$\frac{1}{U_0 A_0}$ can be obtained with different water rates at same value for the rate of heat transfer, q, by varying the vapour-space press. Correlation of data obtained at const value of q places Wilson's method on a rigorous basis.

H.T.C. values as thus determined compare favourably, at low heat-transfer rates, with the calc value from the Nusselt equation. Deviation increases with increased heat transfer, probably due to turbulent flow in the condensate at these high rates. Treatment of author's data on benzene and toluene by Rhodes and Younger's method gives a value of H.T.C. within 5% of that of Rhodes and Younger. Experimental error cannot therefore account for the discrepancy. R. G. T.

1773. Heat Transfer at High Rates to Water with Surface Boiling. W. H. McAdams, W. E. Kennel, C. S. Minden, R. Carl, P. M. Picornell, and J. E. Dew. *Industr. Engng Chem.*, 1949, **41** (9), 1945–1953.—A study is made of heat transfer at high density of heat flux from an electrically heated surface to water flowing in annuli. The relation between heat-flux density, temp difference, pressure, degree of subcooling, and water vel was required. Degassed distilled water flowed up through a vertical glass tube having a centrally located heater with outside dia = 0·25 in. Correlation is given under non-boiling conditions for gassed and degassed water in turbulent flow. Max deviation was 20%. High-speed motion pictures are shown and revealed cyclic formation and complete condensation of vapour bubbles on heater surface. Burnout was shown to be caused by formation of a blanket of vapour on the heater. The peak densities of heat flux were three to twelve times those for non-boiling conditions. R. G. T.

1774. Effective Thermal Conductivities in Gas-Solid Systems. D. G. Bunnell, H. B. Irvin, R. W. Olson, and J. W. Smith. *Industr. Engng Chem.*, 1949, **41** (9), 1977–1981.—Temp measurements have been made in both solid and gas in a 2-in reactor packed with 0·125 in Al_2O_3 cylinders through which hot air was passed at mass vel of 150–500 lb/hr/sq. ft. Entering air temp 400° C—reactor wall at 100° C—by water-jacket. Temp measured at seven points across dia and at bed depths of 0, 2, 4, 6, and 8 in. In spite of significant temp gradients solid and gas temps were identical within accuracy obtained. Temp varied considerably with mass vel. Thus radial heat transfer in a packed bed depends primarily on gas properties rather than on solid pellets. Effective thermal conductivities calc from temp ranged from 0·1 to 0·4

B.T.U/hr/ft/°F. Increase in effective thermal conditions over value at static state is directly proportional to mass vel of gas flow. R. G. T.

1775. Applied Kinetics and Equilibria (Review). O. A. Hougen and J. P. Hsu *Industr. Engng Chem.*, 1949, **41** (9), 1825–1827.—A classification is given of papers which appeared during 1948 on chemical kinetics and thermodynamics. Sections deal with catalysis, dehydrogenation, oxidation, polymerization, and cracking. Extensive bibliography. R. G. T.

1776. Perspective Representation of Intricate Piping Layouts. M. Berger. *Oil Gas J.*, 8.9.49, **48** (18), 98.—Perspective drawings are especially useful to those who are not familiar with the interpretation of conventional drawings as the relationship of the components can be seen at a glance. A conventional drawing, or blueprint thereof, requires a long and intensive study to understand the lay-out indicated, even to one trained in their interpretation. They are also of particular use in explaining work to be carried out, or the lay-out itself, to trainees, to operators, or men engaged in the construction or repair maintenance, and for indicating the whole or any particular component to non-technical people. The two drawings mentioned and isometric drawings are briefly outlined, and the differences in their construction are explained. A perspective drawing of a piping lay-out is illustrated, together with a conventional plan and sectional-elevation-type drawing for comparison. Perspective drawings are not intended to replace conventional plans; they supplement them, and when used in conjunction speed up engineering and construction work. W. H. C.

1777. The Properties of Refractories in Relation to Their Use in Industry. Anon. *Mech. World*, 14.10.49, **126** (3274), 448.—Failure of refractories in use may have a very serious effect upon output, and may even result in complete hold-up of many sections of the work. To ensure maximum economic life it is necessary to pay particular attention to such items as: (i) design of furnace; (ii) temperatures encountered in furnace and flues; (iii) range of temperature variations; (iv) factors peculiar to the particular application of the furnace which may exert harmful influences; (v) selection of particular type of refractory most suitable to stand up to requirements. Refractories in most common use include: (1) silica brick; (2) siliceous brick; (3) firebrick; (4) high-alumina firebrick; (5) chrome brick; (6) chrome magnesite; (7) magnesite brick; (8) dolomite brick; (9) carborundum. The paper discusses some of the most important characteristics of refractories such as texture, porosity, permeability, and thermal volume effects. It also discusses the difficulty of assessing refractories in the laboratory. A. S.

1778. Mineral Oil Separators. W. Opdenberg. *Erdöl u. Kohle*, 1949, **2**, 402–405.—A brief review of the main uses of static and centrifugal separators. Sectional diagrams are given of various types showing variation in construction of separators designed for liquid–liquid and liquid–solid separation, and the distinction between apparatus where either the heavier or the lighter fluid is the major component of the mixture to be processed. V. B.

Distillation.

1779. Distillation Conversion Chart Recovered to Evaporated Basis. P. L. La Tour. *Oil Gas J.*, 15.9.49, **48** (19), 127.—A graphic conversion chart is described, by which A.S.T.M. distillation data on "recovered" basis may be converted directly to temperatures for specific evaporated vol without the necessity of plotting a dist curve.

Results obtained with the chart agree with results from the curve-plotting method within the reproducibility of the actual dist test, and are the same for each set of dist data. G. A. C.

1780. Batch Distillation—Minimum Number of Plates and Minimum Reflux. J. R. Bowman and M. T. Cichelli. *Industr. Engng Chem.*, 1949, **41** (9), 1985–1987.—Binary distillation curves, showing composition of distillate *vs.* fraction of charge left in pot, are characterized by "pole height"—the product of curve gradient at mid-point and

fraction left in pot. Minimum No. of plates and minimum reflux for given pole height are calc from

$$n' = \frac{\text{Log } 8S}{\text{Log } \alpha} \quad \text{and} \quad R' = \frac{2S}{\alpha - 1}$$

where S = pole height, α = relative volatility, R' = minimum reflux ratio, and n' = No. of theoretical plates (minimum). Comparison is made of batch distillations under various conditions of operation.

1781. Distillation of an Indefinite Number of Components. J. R. Bowman. *Industr. Engng Chem.*, 1949, **41** (9), 2004–2007.—Generalization is made of fundamental equations of distillation theory to apply to systems composed of an infinite number of components. The elements of the general infinite set of components are arbitrary, and thus the results apply to systems of any number of components. Compositions are designated by functions of form $x(\alpha)$, where α = classical relative volatility; x functions have property that amount of material in compositions they represent, between α and $\alpha + d\alpha$, is $xd\alpha$. All concns are therefore of form $xd\alpha$ and material balances made on a differential basis. The balances and idealized equilibrium relations are linear and homogeneous in the concns. Thus the factors $d\alpha$ divide out and fundamental equations of distillation on this basis are similar to classical ones.

R. G. T.

1782. A New Distillation Packing. M. R. Cannon. *Industr. Engng Chem.*, 1949, **41** (9), 1953–1955.—A highly efficient distillation packing is described, made of protruded metal. Data are presented for two sizes of packing in 2- and 4-in-dia columns. Packing is readily wetted due to nature of surface. No preflood is required, and equilibrium is quickly attained. Starting time is thereby reduced. The starting material, flat metal, is cheaper than gauze or wire. No complicated loading is required.

R. G. T.

Absorption and Adsorption.

1783. Purification of Five Hydrocarbons by Adsorption. A. J. Streiff, B. J. Mair, and F. D. Rossini. *Industr. Engng Chem.*, 1949, **41** (9), 2037–2038.—Three branched-chain paraffins—2 : 2 : 3-trimethylbutane, 2 : 2 : 4-trimethylpentane, and 2 : 2 : 4 : 4 : 6-pentamethylheptane, and two isomeric alkyl benzenes, 1 : 2-diethylbenzene and 1 : 4-diethylbenzene, have been purified by adsorption with silica gel. F.p. measurements were used to determine purity of the products. Graphs giving f.p. and purity of product as a function of volume are included. R. G. T.

Solvent Extraction and Dewaxing.

1784. Sweating of Paraffin Wax. J. R. Bowman and H. S. Burk. *Industr. Engng Chem.*, 1949, **41** (9), 2008–2012.—A theoretical treatment of the sweating operation in the manufacture of paraffin wax. Performance equations are derived for general case of arbitrary initial composition, giving the composition and m.p. of the products as functions of the yield on following assumptions: (1) that components form ideal solutions; (2) that quenched m.p. are mean values; (3) that m.p. of individual components are linearly related to their respective relative crystallizability. A simple form of the performance equation is given for an ideal case in which the charge contains components uniformly distributed with respect to relative crystallizability. Retention of liquid by the molten cake is also treated theoretically. R. G. T.

Cracking.

1785. Control of the Production of Residual Fuel Oil. G. Armistead. *Oil Gas J.*, 29.9.49, **48** (21), 57.—Methods are reviewed whereby the present 23–27% overall refinery yield of residual fuel oil from crude may be substantially cut to produce distillate products and at the same time obtain some improvements in motor-fuel quality.

The methods involve substitution of catalytic for thermal cracking and the

increased use of catalytic cracking feed-preparation steps such as delayed coking or propane deasphalting.

A table summarizes yields from 38° A.P.I. mid-continent crude using the three processes. G. A. C.

1786. Continuous Contact Coking Process. A. H. Schutte and W. C. Offutt. *World Petrol.*, 1949, **20** (8), 68–73.—Heavy residuum oils and tars left after topping of crude to yield cat charging stock are converted by a continuous process into coke and light products. Residuum is contacted (750–850° F) with a large quantity of hot coke (¼–½ in round lumps) and temp raised to 850–1000° F. Coking of the thin, even liquid film on the solids occurs in a cylindrical reactor through which the solids move freely by gravity giving residence time of 15–40 min. The coke lumps, which are of dense structure, made up of numerous layers 0·001 in thick, are drawn off when ¾ in dia is reached. Investment costs are below those for most conventional coking plants, and striking savings are made on utility requirements. E. B.

1787. Pyrolytic and Catalytic Decomposition of Hydrocarbons. V. Haensel and M. I. Sterba. *Industr. Engng Chem.*, 1949, **41** (9), 1914–1921.—Fundamental experimental work in both thermal and cat decomposition reactions are reviewed. Increased cat cracking is noted—several modifications and improved industrial features are mentioned. Bibliography is extensive. R. G. T.

Alkylation.

1788. Alkylation (Review). R. N. Shreve. *Industr. Engng Chem.*, 1949, **41** (9), 1833–1839.—The review is classified by method of bonding of alkyl group into the rest of the mol. A section deals with alkylation as applied to petroleum processing. Extensive Bibliography. R. G. T.

Isomerization.

1789. Isomerization (Review). S. F. Perry. *Industr. Engng Chem.*, 1949, **41** (9), 1887–1889.—Very few additional articles on paraffins are noted since the previous (1947) review. Commercial applications and possible applications are discussed. R. G. T.

Chemical and Physical Refining.

1790. Desulphurization of Coal during Carbonization with Added Gases—Quantitative Determination of Sulphur Compounds. R. E. Brewer and J. K. Ghosh. *Industr. Engng Chem.*, 1949, **41** (9), 2044–2053.—An investigation into sulphur content was made in an attempt to find methods of increasing conversion of coal S to volatile S compounds, and of determining quantitative distribution of S in coke and tar, and as H_2S, mercaptans, thiophenes, CS_2, COS, and residual S in gas. High S evaluations must be used in future, and thus removal or reduction of the undesirable S is imperative. Factors which increase the desulphurizing action—lowering of S in coke—are reviewed and their relative merits discussed. Sulphur balances are made from determination of individual S compounds in the gas and of S in coke and tar. Knowledge of S compounds in gas provides a valuable guide to improving methods of purifying gases. R. G. T.

Special Processes.

1791. Decomposition of Alcohols over Nickel–Kieselguhr and Other Catalysts. V. N. Ipatieff, G. S. Monroe, L. E. Fischer, and E. E. Meisinger. *Industr. Engng Chem.*, 1949, **41** (8), 1802–1805.—Cleavage of primary alcohols in presence of nickel–kieselguhr catalysts at 1 and 35 atm pressure yields mainly hydrocarbons with one C atom less than the parent alcohol. Reaction is assumed to proceed via the aldehyde. *n*-Butyl alcohol showed the following effect of various factors on alcohol decomposition. Pressure suppressed decomposition. Cat composition has marked effect. Ni substituting with other metals to decrease the yield of propane or alter the type of product. Decomposition of the secondary aliphatic alcohols gives corresponding ketone as main product. Cyclic secondary alcohols decompose, with water, to give only traces of

ketones and mainly phenols and aromatic hydrocarbons. Decomposition of tertiary alcohols yields olefins which suffer partial oxidn to hydrocarbons. R. G. T.

1792. Combustion (Review). B. Lewis and G. von Elbe. *Industr. Engng Chem.*, 1949, **41** (9), 1851–1860.—Fundamental research is mainly concerned with flame, spark ignition, and chemistry and mechanism of oxidation reactions. Interest in the gas turbine competes with piston engines in the applied field. Combustion in furnaces and papers on smoke abatement are extensively reviewed. Extensive bibliography. R. G. T.

1793. Fine Chemicals from Coal. W. H. Shearon, Jr., H. E. Hall, and J. E. Stevens, Jr. *Industr. Engng Chem.*, 1949, **41** (9), 1812–1820.—Production of fine chemicals is described by the side-chain chlorination of toluene. Principal fine chemicals made by hydrolysis of the chlorides are benzoic acid, benzoyl alcohol, and benzaldehyde. The process is described from coal production to finished chemicals. A flow sheet is included, and physical properties of the chlorination products are tabulated. Materials of construction for the various items of plant are listed. R. G. T.

1794. Oxidation (Review). L. F. Marek. *Industr. Engng Chem.*, 1949, **41** (9), 1892–1899.—A new tonnage oxygen plant has made possible expansion of petrochemical production. Oxidation of liquid hydrocarbons and other organic compounds including drying oils is reviewed. Bibliography is extensive. R. G. T.

1795. Solidification of Petrol. L. R. B. Shackleton. *Industr. Chem.*, 1949, **25**, 423–429.—In principle an org liquid (*e.g.*, petrol) is made the disperse phase in emulsification with an aq solution or suspension forming the continuous phase which solidifies on standing. The org liquid remains in its natural state, but flow is prevented and inflammability reduced, whilst danger of contamination is slight, as the liquid is in a different phase. For solidified petrol a urea–formaldehyde resin composition was found satisfactory, and products containing 94·5% petrol, 2·75% water, and 2·75% solids were obtained from which 90% of petrol could be expressed. Dist or steam stripping were less convenient methods of recovery. Composition and properties of reagents and methods of preparation of the emulsion of petrol and resin-forming components are described. Diagrams of plant including recovery presses are given. Factors such as pH, temp, and cat affecting the processes of emulsification and resinification and the final degree of hardness are discussed. T.E.L. neither affects nor is affected by the process. Gum is increased in spirit containing benzole or unsaturated hydrocarbons, so that it is preferable to process S.R. gasolines. Light tin-plate containers are suitable for the transport of the solid, and it can be stored under water. Tracer bullets fail to ignite the solidified petrol, which when ignited can be put out with a damp cloth, water, or foam. E. B.

1796. Oil Industry and Sulphur Recovery. O. W. Willcox. *World Petrol.*, 1949, **20** (9), 42–45.—Processes are described for the recovery of hydrocarbons from sour gas, production of a special boiler-flue gas for reservoir injection for pressure maintenance and manufacture of S from H_2S. H_2S and CO_2 are absorbed by monoethanolamine solution in two stages at 46 and 152 p.s.i., and hydrocarbons are subsequently removed by compression and absorption in oil. S is produced by a modified Claus process whereby part of the H_2S is burned to SO_2, which then reacts with the remaining H_2S forming S. Gases enter a reactor at 450° F and leave at 740° F. S is condensed at 300° F, and the residual gases are heated and passed through a second reactor, which leaves $< 1\%$ H_2S. E. B.

Metering and Control.

1797. Instrumentation Flow-Plan Symbols. D. E. Hostedler. *Oil Gas J.*, 15.9.49, **48** (19), 80.—The object of the article is to present a satisfactory system of symbols and identifications for industrial process-instrumentation equipment, to designate and identify such equipment on flow plans and in other requirements.

Tables give letters of identification, complete general identification (combinations of letters), and six charts depict typical instrumentation symbols for flow, temp, level, pressure, combined instruments, and miscellaneous. G. A. C.

1798. Superheated Steam Flow. J. R. Finniecome. *Mech. World*, 7.10.49, **126** (3273), 411.—Formulæ and curves are presented which are aimed to assist in the rapid and accurate determination of quantity of steam flow through nozzles at a discharge coeff $a = 1{\cdot}0$. The first set of curves shows the variation of the flow factor with pressure over a range of temp, and the second set of curves shows the variation of the gas constant with pressure over the same temp range. A. S.

1799. Metering of Liquid Fuel Flow. Accuracy in Orifice Flow Meters. J. Stringer. *J. Iron & Steel Inst.*, 1949, **163**, 168–172.—Variations in physical properties cause inaccuracies in the metering of oil with square-edged and sharp-edged orifice flowmeters. A nomogram, given in this paper, facilitates correction for these inaccuracies when the Reynolds number in the orifice lies between 500 and 3000.

A means of reducing these inaccuracies, by controlling the temperature of the oil, is discussed, and is shown to be possible without undue interference with the requirements of the atomizer and burner.

The precautions which must be taken to ensure consistency within $\pm$ 1% of indicated flow are stated, and close control of the oil temperature is shown to be necessary. Special orifices, insensitive to viscosity changes, are available, but they are still subject to errors due to specific-gravity changes.

The need is emphasized for a continuous viscometer of moderate accuracy as an aid to metering and to furnace control. (Author's abstract.)

1800. Process Control—by Graphic Panel. D. M. Boyd. *Oil Gas J.*, 15.5.49, **48** (19), 86.—The Rock Island Refining Co.'s control room at their Indianapolis refinery is described. The refinery operated a combined crude and thermal cracking unit, and a fluid catalytic cracking unit, with facilities for the production of liquefied petroleum gas. The graphic-panel type of system with its smaller type of instruments, and pneumatic set controllers where required, was used. G. A. C.

1801. Fundamentals of Industrial Thermostatic Control. L. Walter. *J. Inst. Heating Ventilating Engrs*, 1949, **17**, 310–335.—Choice of thermostats for heat-flow processes is based on knowledge of process characteristics. Using a symbolic heat exchanger, basic factors of thermal control are explained. Controller qualities which influence control accuracy are responsiveness of a temp regulator, which must suit process reaction rate, and the way in which it reacts to maintain or re-establish heat balance. A few control terms are explained. G. S.

1802. Precision Vacuum Gauge. G. C. Fryburg and J. H. Simons. *Rev. sci. Instrum.*, 1949, **20**, 541–548.—A pressure-measuring device of the type first described by Knudsen has been constructed for obtaining precision measurements of gaseous pressures in the range 10^{-5}–10^{-3} mm Hg. The instrument has been calibrated with the aid of a McLeod gauge in N_2, H_2, O_2, CH_4, C_2H_4, n-C_4H_{10}, and *iso*-C_4H_{10}. The mechanical precision of the instrument seems to be better than $\pm$ 0·5%, and the accuracy of the calibrations is probably of the order $\pm$ 1%. Calibration curves for the above gases have been treated analytically, and equations for the different gases have been discussed. An empirical method of calibration has been described for calibrating the instrument in condensible gases whose pressures cannot be measured in a McLeod gauge. (Author's abstract.) H. C. E.

PRODUCTS.

Chemistry and Physics.

1803. Combination Scattering Spectra of Aromatic C_8 Hydrocarbons. E. G. Treshchova and V. M. Tatevskii. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **61**, 841–844.—Line intensities (in the wavelength range 157–3092 cm^{-1}) are given for ethyl-benzene and *o*-, *m*-, and *p*-xylene, all in *cyclo*hexane solution, excited with Hg radiation. The *m*-xylene used was not checked for purity, and the results of spectral analysis indicate a possible content of 8–9% of the *p*- and 10–12% of the *o*-forms. Both a registering and a rapid form of photometer were employed. V. B.

1804. Cyclization of Paraffin Hydrocarbons Containing a Quaternary Carbon Atom and the Mechanism of Aromatization of Paraffins on Platinized Charcoal. B. A. Kazanskii, A. L. Liberman, and M. I. Batuev. *Doklad. Akad. Nauk S.S.S.R.*, 1948, **61**, 67–70.—Aromatization of 3 : 3-dimethylhexane at 290–300° C on platinized charcoal yields a product containing 1 : 1-dimethyl*cyclo*hexane (identified optically) indicating that cat cyclization reaction is paraffin ⟶ *cyclo*hexane ⟶ aromatics and not paraffin ⟶ aromatics. In tests at 300–346° the intermediate naphthene product could not be detected. Full experimental details are given. V. B.

1805. Infra-red Absorption Spectra of *cyclo*-Hydrocarbons. E. K. Plyler and N. Acquista. *Bur. Stand. J. Res., Wash.*, July 1949, **43** (1), 37.—Infra-red absorption spectra of hydrocarbons have been measured for purpose of identification by means of characteristic bands. Such data are also useful as measure of purity of compounds. In this case the investigation is primarily concerned with absorption spectra of some *cyclo*pentanes and *cyclo*hexanes in the 3·4-μ region. The spectra of nineteen hydrocarbons have been measured in the 3·4-μ region, and the location of the two CH_3 vibrations has been determined. The latter occur at 2854 and 2927 cm^{-1} for methyl*cyclo*hexane, and 2866 and 2952 cm^{-1} for methyl*cyclo*pentane. For *cyclo*hexene the wave numbers of the bands are 2845 and 2934 cm^{-1}, and for *cyclo*pentene they occur at 2853 and 2959 cm^{-1}.

The region from 2 to 4 μ has been measured for methyl*cyclo*hexane, ethyl*cyclo*hexane, *cis*-1 : 2-dimethyl*cyclo*hexane, *trans*-1 : 2-dimethyl*cyclo*hexane, and the corresponding *cyclo*pentanes. In addition, the spectra of *cyclo*hexene and *cyclo*pentene have been measured from 2 to 4 μ. A. S.

1806. Oxidation Behaviour of Hydrocarbons. VI. Action of Antioxidants on the Oxidation of Lubricating Oil. C. Kröger. *Erdöl u. Kohle*, 1949, **2**, 389–396.—Test oil was a non-hydrogenated synthetic lub oil having d_{20} 0·849, I val 4·6, an. pt. 123° C, and visc 51·9 cp at 50° C. Oxidn was carried out (150° C) in a micro apparatus using 1 g oil containing 1% of additive. O_2 absorption (A) was measured by pressure diminution, and can be expressed as $A = az + b$, where a is the pressure fall (mm/10 min) and b denotes either the inhibiting (−ve value) or accelerating (+ ve value) action of the additive, z being test duration (min). Effectiveness of the inhibitor is denoted by the ratio of a for the doped oil to that of a for the straight oil. 137 organic compounds (divided into fifteen groups) were tested, and the results are tabulated. Most of the compounds examined were aromatics. The most effective material was 1-aminoanthracene. Relationship between additive structure and inhibitory action is discussed in some detail. Aliphatics are less effective than aromatics. Antioxidant action depends on an activity centre within the mol, such centres being substituents containing S, N, or O. The para-position in an aromatic ring is the most effective for a substituent group, and α isomers are more active than β. Substitution of H by CH_3 increases activity to a marked extent. Monomethylamines show especially pronounced activity. Inhibitory action increases with mol compactness, and anthracene derivatives are the most effective. Some of the more pronounced inhibitors were also tested at 175° C; influence of temp increase is very variable, but numerous compounds retain marked activity at the higher temp. V. B.

1807. Oxidation of Hydrocarbons. Observations on the High-Temperature Reaction. M. F. R. Mulcahy. *Trans. Faraday Soc.*, 1949, **45**, 537–541.—Rates of oxidn of several substances containing three C atoms/mol are measured and compared over a range of temp in which the low-temp mechanism (operating up to 300° C) changes to the high-temp mechanism (predominating > 400° C). Hydrocarbon structure is shown to affect the rate of oxidn very much less in the high-temp range, and it is believed that peroxides are no longer formed. The reaction is, however, autocatalytic, indicating a fairly stable intermediate product. E. B.

1808. Oxidation of Hydrocarbons. Some Observations on the Induction Period. M. F. R. Mulcahy. *Trans. Faraday Soc.*, 1949, **45**, 575–584.—Kinetic relationships governing the oxidn of *n*-butane, propylene, and (probably) *iso*butane in its early stages are different from those which apply when the reaction reaches full velocity. A linear relationship exists between the reciprocal of the induction period and the

product of hydrocarbon and oxygen concn. Nature of the surface of the oxidn vessel and temp influence the length of the induction period. E. B.

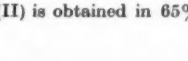
1809. Slow Oxidation of 2-Methyl Pentane. C. F. Cullis. *Trans. Faraday Soc.*, 1949, **45**, 709–714.—Kinetics of the reaction studied are similar to those of *n*-paraffins, though peroxide and aldehyde yields are lower. Some ketones are formed, but only in small quantities, indicating that attack at the CH group in the hydrocarbons, giving rise to *tert*-peroxide decomposing to ketone, is not important compared with attack at CH_2. E. B.

1810. Magneto-optic Rotation of Hydrocarbons. E. G. Foemr and M. R. Fenske. *Industr. Engng Chem.*, 1949, **41** (9), 1956–1968.—Measurement is described, of the magneto-optic rotation and dispersion of various classes of hydrocarbons, especially in mol-wt range 250–450. The limitations imposed upon the use of magneto-optic-rotation methods for the analysis of binary mixtures are discussed. Parameters are developed for the prediction of rotation of individual members in homologous series of hydrocarbons. R. G. T.

1811. Metastable Transitions in Mass Spectra of Hydrocarbons. E. G. Bloom, F. L. Mohler, C. E. Wise, and E. J. Wells. *Bur. Stand. J. Res., Wash.*, July 1949, **43** (1), 65.—A compilation is given of metastable transition peaks in mass spectra of about 170 hydrocarbons based on experimental data that have been published in the American Petroleum Institute *Catalog of Mass Spectral Data*. One hundred different transitions have been found and identified, and these are tabulated according to the mass lost in the transition. Masses lost are 1, 2, 15, 16, 26, 27, 28, 29, 30, 40, 42, 43, 44, 56, 57, and 58. Nearly all the observed metastable transitions can be accounted for as single dissociation processes. In this dissociation one additional hydrogen atom may be transferred to either the charged or uncharged fraction of the dissociating ion. The data include those previously reported in Research Paper 1888. A. S.

1812. Isobaric Heat Capacity of 1-Butene and 1-Pentene at Bubble Point. W. G. Schlinger and B. H. Sage. *Industr. Engng Chem.*, 1949, **41** (8), 1779–1782.—Determination was made of the isobaric heat capacity at bubble point of 1-butene and 1-pentene at temps from 90° to 200° F. A constant-volume adiabatic calorimeter was used for these measurements in the α-phase region. Supplementary volumetric data were then used to calculate the heat capacity from the isochoric values. The data were obtained experimentally for 1-butene, and estimated from the law of corresponding states for 1-pentene.

Tabular and graphical results are included. R. G. T.

1813. Formation of a Tetrahydrofuran Derivative from Diallyl. D. J. C. Wood and L. F. Wiggins. *Nature*, 1949, **164**, 402.—When diallyl is treated with perbenzoic acid, 1 : 2–5 : 6-diepoxyhexane (I) is produced in 80% yield. When (I) is boiled with water, scission of the epoxide rings is effected, and 2 : 5-*bis*-hydroxymethyl tetrahydrofuran  (II) is obtained in 65% yield. Proofs of the constitutions of (I) and (II) are given. H. C. E.

1814. Kinetics of Interphase Rate Processes. D. W. Van Krevelen. *Ingenieur*, 21.10.49, No. 42, Ch. 34.—The velocity-determining steps in interphase-rate processes are analyzed. In this analysis the film theory is used as a model-conception. A classification of boundary layers in flow processes is given. It proves that on account of the model-conception used, the empirical correlation of reactions between solid substances and fluids, as well as those between gases and liquids, may be interpreted in a satisfactory manner. R. R.

1815. Rheological Measurements and Adhesion. E. W. J. Mardles. *Nature*, 1949, **164**, 324.—With liquids showing non-Newtonian behaviour (high-visc lubricants, petroleum jelly, etc.) rheological measurements are affected by the nature of the liquid–solid interface. Polished rods of glass, steel, and wood of the same weight and shape, when allowed to fall through a lime-base grease, penetrate different distances

and with different velocities. When the rods are coated with cellulose varnish, the distances and velocities are the same. Results of experiments, in which the amount of grease adhering to strips slowly withdrawn from a well of grease are measured, suggest that the influence of surface adhesion extends some way into the bulk of the lubricant. This effect can also be seen by measuring the flow of 1 g grease between plates of different materials when subjected to the same load.

When plates are allowed to sink into a pool of liquid, the curve showing the calculated thickness of the film at different periods of sinking has the same shape as curves obtained directly with liquids between plates either separating or approaching. It is found that the ease of sliding one plate over another is greater, the greater the thickness of the lubricant between them.

The yield value of grease may be obtained by resting rods of different weight but the same cross-section on its surface, and noting the weight of the rod just showing penetration after resting overnight; but the influence of different materials for rods is again apparent. H. C. E.

1816. Dimensions and Intrinsic Viscosity of Coiled Chain Molecules in Solution. E. D. Kunst. *Nature*, 1949, **164**, 535.—The various theories of the viscosity of high-polymer solutions can be experimentally examined by measuring the molecular sizes, molecular weights (M), and intrinsic viscosities (η). The molecular size is expressed as R, the root mean square distance between the ends of the coil. Results are reported for four fractions of polystyrene and four fractions of poly*iso*butylene. It is found that: (*a*) R can be made to vary independently of M by changing the solvent; (*b*) η is essentially a function of R only. It is concluded that none of the existing theories is confirmed by experiment. H. C. E.

1817. Representation of Viscosity–Temperature Characteristics of Lubricating Oils. J. M. Ramser. *Industr. Engng Chem.*, 1949, **41** (9), 2053–2059.—In discussion of general relation between visc and temp, it is shown mathematically that V.I. and A.S.T.M. slope are not the only measures of fractional change of visc with temp, since visc enters the relations as an independent variable. The average fractional change of visc, computed over comparable sections of temp–visc curve between const-temp limits is considered. Point at which curvature of visc–temp curve is max was calc for wide range of oils. Absolute visc change with temp has const value at this point. A method of evaluating oils under operating conditions is proposed involving measurement of visc–temp characteristics. R. G. T.

1818. Viscosity Temperature and Pressure of Lubricating Oils. R. T. Sanderson. *Industr. Engng Chem.*, 1949, **41** (9), 2059–2061.—The effect of pressure and temp on visc of some pure hydrocarbons in light-lub.-oil range has been studied. Exact equivalence has been found between compression at 100° F and cooling at 1 atm pressure and evaluated as linear relation between P and log T. Thorough evaluation of the applicability of petroleum lub. oils is not yet possible, but prediction of the effect of presence on kin. visc, from knowledge of visc–temp properties, is claimed. R. G. T.

1819. Viscosity of Normal Paraffins near the Freezing Point. E. B. Giller and H. G. Drickamer. *Industr. Engng Chem.*, 1949, **41** (9), 2067–2069.—Measurement is described of visc of series of normal paraffins over temp range down to f.p. and into supercooled region. Free energy of activation is shown to be substantially independent of temp except at f.p. and below. The increase in latter region is probably due to increased mol orientation. Relation between f.p. of compounds and f.p. viscs is derived. R. G. T.

Analysis and Testing.

1820. Estimation of Non-Ionic Detergents. J. Oliver and C. Preston. *Nature*, 1949, **164**, 242.—Non-ionic detergents having the structure $RO(CH_2CH_2O)_nH$ are prepared by reaction of ethylene oxide and organic bodies containing OH groups. This type of detergent can be estimated by precipitation with phosphomolybdic acid in the presence of HCl and $BaCl_2$. The precipitate is boiled to obtain coagulation, filtered through a sintered glass crucible, and dried at 100° C to constant weight. Known

amounts of detergent are thus precipitated, and the weight of detergent *versus* weight of complex are plotted to give a rectilinear graph for that particular detergent. The accuracy is *ca* $\pm 1{\cdot}5\%$. Sulphate interferes with the determination and must be removed. H. C. E.

1821. Alumina and Alumina-Supported Catalysts—Electron Microscope Studies. P. G. Nahin and M. C. Huffman. *Industr. Engng Chem.*, 1949, **41** (9), 2021–2027.—Electron microscope studies have been made of various alumina phases, a synthetic gel-type, Al_2O_3 cat support calcined at high temp, fresh and thermally deactivated molybdena–Al_2O_3 and cobaltia–molybdena–Al_2O_3 cats. Qualitative correlations are made among electron optical, cat activity, X-ray diffraction, and surface area data obtained in studying heat stability of the two Al_2O_3-supported cats which are of interest in pet refining. The electron microscope is claimed as a valuable supplementary tool when used together with such techniques as X-ray diffraction and reaction kinetics. R. G. T.

1822. Modern Methods of Gas Analysis. R. Sigwalt and A. Gislon. *Bull. Assoc. franç. Tech. Pétrole*, 1949, (77), 29–43.—Two modifications of the Lebeau–Damiens low-temp method (suitable for H_2, O_2, N_2, and hydrocarbons up to C_4) are described, involving careful ($\pm 1°$ C) control of gas temp and an improvement in the measurement of gas vol. Tests can be made on 5 ml of gas, and an average mean accuracy of $0{\cdot}5\%$ is attainable. Analysis takes 10 hr, and the cost of the apparatus is approx £150. Operating details and diagrams are given. Some comments on the use of Podbielniak and infra-red methods are made. V. B.

1823. Dust and Asphalt Content of Low Temperature Coal Tars and Tar Oils. R. E. Heinze and E. H. Goebel. *Erdöl u. Kohle*, 1949, **2**, 397–400.—Determination of xylene-insol is unsuitable as a purity test for low-temp tars, since xylene acts as a precipitant, the insol increasing with higher xylene/tar ratios. Impurities should be confined to material genuinely insol in organic solvents, thus excluding certain high-mol.-wt. compounds which can be valuable constituents of tars and which are pptd by xylene. Examination of a No. of solvents shows pyridine or butanone to be suitable, the amount of insol varying little with solvent/tar ratio. Butanone is preferred owing to its lower toxicity. It is also suitable for the determination of insol in mineral oils. Certain tar components are insol in "normalbenzin" and ether–alcohol mixtures. Such components are, however, quite different from pet fractions insol in these solvents, and the terms "hard" and "soft" asphalt should not be applied to them. The proportion of tar constituents insol in "normalbenzin" is, however, related to C.R. (Con.), and is of value as indicating behaviour when the tar is used as fuel. V. B.

1824. Viscosity–Temperature Charts of Increased Usefulness. G. C. Donovan. *Oil Gas J.*, 15.9.49, **48** (19), 98.—Two nomographic charts and sets of tables of additive visc values are presented. The tables enable the calc of visc of any blend of two or more oils, and calc of crank-case dilution in a given engine oil is made possible, as well as the accurate calc of visc at any desired temp, once the visc of an oil at any two temp are known. G. A. C.

1825. Significance of Properties of Petroleum Products—III. Volatility. E. B. Evans. *J.P. Review*, 1949, **3**, 265.—Pure compounds can be divided roughly into "volatile" and "non-volatile," but in actual fact most compounds are volatile to a certain extent. Petroleum products are mixtures of compounds of different boiling points, and tests have been devised to obtain information upon the volatility of every type of petroleum compound in such a way as to provide a means of assessing its performance when employed in a certain way. The distillation test is indicative of the boiling range and is carried out on gasoline, kerosine, and fuel oil. The vapour pressure indicates volatility of a light petroleum spirit, and is usually determined on the Reid apparatus at 100° F. It is important in carburation. The loss on heating test gives the amount of volatiles in transformer oils and bituminous products when heated for a certain period of time at a certain temperature. The flash point is an indication of the amount of more volatile material, and is carried out with differing instruments upon the whole range of petroleum products. R. H.

Gas.

1826. Gas Flow in Long Pipelines. J. Joffe. *Chem. Engng*, 1949, **56** (8), 130–131.—A simplification is given of isothermal flow of non-ideal gases at high pressures and in long pipelines. Correction-factor plots are supplied for gases showing normal behaviour and for natural gas containing methane up to 5 atm and val of Tr between 1·05 and 2·4. (Tr = Temp/crit. temp.) R. G. T.

1827. Specific Heats of Natural Gases. P. Buthod. *Oil Gas J.*, 29.9.49, **48** (21), 60.—From the average crit pressure and temp for a natural gas of a given specific gravity, with the determination of the sp. ht. at high and atmospheric pressure with correction for all conditions of pressure and temp, charts have been constructed showing specific heats at 0·55, 0·6, 0·7, 0·8, and 0·9 sp. gr.

Sp. ht. at any pressure and temperature can thus be determined; actual examples with their solutions are provided. G. A. C.

Engine Fuels.

1828. Performance Significance of Laboratory Octane Numbers. L. A. McReynolds and W. W. Suderman. *Oil Gas J.*, 8.9.49, **48** (18), 71.—It is well known that the performance significance of motor and research O.N., used singly, is limited. Many authorities have presented data using a combination of the two methods as giving the best correlation with road performance in modern automobiles, but opinion differs as to the specific relationship of the two methods.

In the series of tests carried out on seventy-six fuels, knock data was obtained by the A.S.T.M. motor method D-357, and the A.S.T.M. research method D-908. Road tests were carried out on the same fuels, in eighty-nine different cars representing eight models and types, using the C.R.C. Borderline road-test procedure. Two of the instruments used were: a positive-action non-backlash spark-advance control mechanism, and a stethoscope which is described.

The results are discussed and shown in six graphs. They show that the best average correlation with road testing is found when laboratory ratings are weighed between 60 and 75% research rating plus 40–25% motor rating. The resulting value is termed the weighted index O.N.

Comparisons of road octane ratings at 1000 r.p.m. and (1) motor octane ratings; (2) research method ratings, show the following algebraic, average, root mean square, and maximum deviations:—

(1) +4·67, 4·67, 5·37, 11·0.
(2) −1·58, 1·88, 2·15, 4·6.

The deviations for the weighted index rating of one-third motor rating plus two-thirds research rating were:

0·54, 1·01, 1·29, 3·6.

These clearly indicate the superiority of the correlation to predict road ratings in the critical operating range, both from the viewpoint of spread and cleavage to the equality line. Other relevant data are discussed, and it is shown that varying sensitivity has little effect on the road-weighted relationship, while increasing the difference between road and the motor and research values. W. H. C.

1829. Burners for Supersonic Ram-Jets—General Aspects of the Problem. J. W. Mullen II. *Industr. Engng Chem.*, 1949, **41** (9), 1935–1945.—An introductory paper to the general problems encountered in development of useful burners for supersonic ram-jets. An account of elementary theory is included to explain the mechanism whereby a ram-jet obtains its thrust and the effect of the burner in producing the driving-force. Internal flow conditions in a ram-jet are discussed, emphasizing the high linear velocities in the region where heat is added to the air stream. The critical problem is flame stabilization at these high velocities to produce useful combustion as a continuous-flow process. A solution to the problem is briefly described, and several difficulties encountered in burner development are presented. Satisfactory burner requirements are listed, and the influential variables discussed. Fuel considerations and effect of fuel type on burner and ram-jet performance are discussed. R. G. T.

1830. Effect of Pressure on Velocity of Burning. J. W. Linnett and P. J. Wheatley. *Nature*, 1949, **164**, 403.—Gaydon and Wolfhard have stated that in stationary premixed flames of hydrocarbons at sub-atmospheric pressures the flame speed is independent of pressure.

Published results at pressures > atmospheric show that for 12% C_2H_2–air mixtures this statement is almost correct; for mixtures of air with CH_4, C_6H_6, CO, benzine vapour + 6% C_2H_2, and ether, the relation between burning velocity V and pressure P is: $V = (k_1\sqrt{P} + k_2)/P$, where k_1 and k_2 are constants. At pressures between 27 and 77 cm Hg the burning velocity of C_2H_4–air mixtures (7, 8 and 9% C_2H_4) varies inversely as $P^{0.25}$.

[Reply by A. G. Gaydon and H. G. Wolfhard.]

(1) Flame velocity is difficult to measure because it is not exactly constant in the stability region. (2) The dia of the burner must be made inversely proportional to the pressure, which was not done in the experiments quoted above. (3) In experiments with C_2H_2–air the effect of N_2 is to cause V to pass through a maximum as P is reduced; when the N_2 is replaced by argon there is no measurable change in V.

H. C. E.

Lubricants.

1831. Glycol Lubricants. A. E. Williams. *Mech. World*, 7.10.49, **126** (3273), 415.—New series of synthetic materials, based on polyalkylene glycols, has been developed and successfully applied as lubricants to many branches of industry. Some of the characteristics making polyalkylene glycols and their derivatives successful as lubricants include high resistance to formation of sludge and carbon, little visc change with change of temp, and stability over long periods of use. The paper gives a number of examples of their successful application in high- and low-temp bearings. Another important property is the fact that these lubricants contain no sulphur, and are therefore an advantage in lubrication of hydrogen compressors in hydrogenation plants wherein catalyst used is commonly very sensitive to ill-effects of sulphur. In lubrication of gears these lubricants have high load-carrying capacity and anti-wear properties which in many instances permit gear operation without use of additives. Other applications include metal cutting, wire drawing, hydraulic fluids, shock-absorber fluids in addition to those included under general lubrication. In some hydraulic applications the inflammability of the fluid is an important point, and safe fluids are available for such applications as aircraft use, hydraulically operated die-casting machinery, furnace controls, mud-guns, presses, etc.

A. S.

1832. Paraflow in Refrigerator Oils. H. Steinle. *Erdöl u. Kohle*, 1949, **2**, 400–402.—Tests were made on a white refrigerator oil to which varying amounts (up to approx ½%) of "Paraflow" and "Paraflow-Extra" had been added. Resistance of the oil to the action of SO_2 (as indicated by colour change) was markedly decreased. Corrosion of Fe and Cu by the doped oils was very little greater than with undoped. Paraflow addition diminished slightly the amount of material precipitated from the oil on mixing with refrigerant. The "flock" test of the oil (cloud point on a 1 : 10 mixture of oil and refrigerant) was lowered 2–6° C by paraflow-extra. It is concluded that such doping of ice-machine oils cannot be recommended, since loss of SO_2 stability and increased risk of corrosion outweigh the slight improvements found in other characteristics.

V. B.

Bitumen, Asphalt, and Tar.

1833. Continuous Hot-mix Plant Averages 4000 Tons Weekly on Georgia Road Job. Anon. *Rds and Streets*, Aug. 1949, **92** (8), 78.—Employing continuous hot-mix plant Dickerson Inc., Monroe, N.C., averaged 4000 tons weekly of hot-mix on the Rome–Rockmart road, in Georgia. The base-course aggregate consisted of crusher run stone, and the mortar for the binder, of local top-soil. Coal-tar prime was applied to the completed base course, and cured before the binder course was laid. This contained 5% AC8 85/100 pen bitumen, and stone whose grading is indicated. The wearing course (again the grading is indicated) contained 7% of the same 85/100 pen bitumen. In each case the aggregate was grey limestone of average apparent sp. gr. 2·8.

R. H.

1834. Intimate Mix Obtained on Oklahoma Bituminous Soil Stabilization. V. J. Brown. *Rds and Streets*, Aug. 1949, **92** (8), 45.—The Oklahoma Highway Commission has engaged on a programme of bituminous soil stabilization. The process was as follows.

The grading was corrected by the addition of a granitic sand, and the soil allowed to stand one year before stabilization was commenced. In the case in point, laboratory survey at 1500-cu.-yd. intervals indicated soil types ranging from A1 to A4. The laboratory recommended the amounts of bituminous material for each type of soil. A variation of $\pm 0{\cdot}5\%$ was found permissible, this being checked by a mobile laboratory. The soil density was 125 lb/cu. ft. The road bed was shaped and rolled, the shoulders being left uncompacted. 8-ft linear sections were stabilized by the P. & H. Stabilizer in three stages, the central portion first, followed by each side portion in turn to a depth of 8 in. The M.C.3 cutback supplied from a refinery 500 miles away at a temperature of 200° F was received in the stabilizer at 165–175° F. After $\frac{1}{2}$–$\frac{3}{4}$ mile had been mixed, the mix was aerated to remove volatiles by windrowing, this taking three days or even longer in rainy weather. No moisture contents were determined, but visual estimation of drying relied upon. The mix was then rolled with a pneumatic roller. Traffic was allowed on this 8-in depth of stabilized base until a sufficient mileage had been completed to allow surfacing. A single surface treatment of A.C-4 asphaltic cement (0·3–0·5 gal per sq. yd.) over a prime coat of MC-1 (0·2–0·35 gal per sq. yd.) and then covered with $\frac{1}{2}$-in chips (1 cu. yd. per 60–80 sq. yd.). This was then broom-dragged and rolled. The shoulders were placed loose, not compacted, then rolled and covered with a $1\frac{1}{2}$-in layer of $\frac{3}{4}$–$\frac{1}{2}$-in chips not bound by bitumen.

R. H.

Special Hydrocarbon Products.

1835. Designing an Aerosol Deodorant. L. Bech and H. R. Shephard. *Soap Sanitary Chem.*, Sept. 1949, **25** (8), 136.—An aerosol deodorant was tentatively designed on the basis of an analysis of odour problems in the home.

The theoretical and practical considerations of a household deodorant are considered, and the commercial production is discussed. The research carried out and the Bostwick odorometer and procedure used are described. Freon is used to disperse the ingredients into the test chambers, and the olfactory tests for determination of the odour threshold are made by release of controlled volume, pressure, and duration pulses therefrom.

The results using pyridine as malodorant are given in a graph showing the relationship between dew point and odour threshold. The odour threshold decreased as the dew point increased within the limits of 50–70° F. Some secondary results indicate that masking, at most, could raise the threshold by roughly ten times and still keep within bounds of ordinary odour intensities.

Kerosine is not suitable as a carrier, because its odour has to be masked. Concerning the choice of a carrier, it is observed that: (1) for effective adsorption the carrier should have wetting properties to adsorb and absorb the water-soluble malodorants; (2) in order to remove solid particles from the air, it must wet the colloids to make them heavier; (3) in order to eliminate smoke, etc., from the air, the carrier, in aerosol form, must possess a negative charge.

An asymmetric molecule is required which is polar, it should also have a fixed dipole movement. A compound was found which fulfils the requirements noted, it is known as "valium."

W. H. C.

1836. Petroleum Fractions. F. W. Stoyle. *Paint Mnfr.*, Oct. 1949, **19** (10), 354; *I.P. Review*, 1949, **3**, 341.—The use of petroleum-oil fractions in the manufacture of printing-inks has been investigated by the British Printing Ink Association. The availability of these fractions enables the production of inks especially suited to the newest developments in modern printing machinery, particularly for machines operating at high speed. At present the supply of these fractions is confined to the U.S. Some member firms have reached the experimental stage in the use of fractions, and therefore it is desirable to have available reasonable quantities of these fractions. Enquiries into the need of or possible use of these fractions by other industries, would be profitable, so that their requirements could be added to those of the printing-ink

industry. In this way it may be possible to establish a demand economically worth satisfying.

A provisional specification of the fractions which has so far been developed by the members of the Association is presented. D. K.

1837. Examination of Wax Suspensions by Turbidimetric Methods. M. E. Bolton and A. W. Marshall. *Soap Sanitary Chem.*, Sept. 1949, **25** (9), 129.—An investigation has been made to produce oxidized paraffin wax suitable for the manufacture of water-emulsion polishes or " dry-bright " polishes.

It was considered that the best approach would be by obtaining data pertaining to the simple systems of oxidized petroleum wax, organic acid, base and water, later, work was extended to include soap and borax as emulsifying agents.

Particle size undoubtedly affects the dry-bright quality of films deposited from polish emulsions, and is also related to the stability of the emulsions. Attention was therefore directed to the use of a simple visual turbidometer for characterizing such emulsions. A Parr S-3 instrument was adapted for the measurement of particle size for the study.

The means of obtaining the extinction-path length of the sample, and the theory of light scattering which relates the average particle weight of suspended or dissolved substances to turbidity, are discussed.

The results obtained with the various emulsions examined are shown in six graphs and discussed. Three photomicrographs of emulsions are illustrated.

The turbidometer may be used as a basis of correlation of such emulsion characteristics as optimum gloss and stability, or for control of production of water-suspension polishes. Maximum gloss is obtained at the minimum particle size obtainable with a given wax. An excess of emulsifying agent above that point decreases gloss. Much excess reduces stability. Optimum particle size for best gloss appears to be in the range 0·06–0·075 μ average particle dia. Gloss may be improved by the use of hard glossy inert materials, provided the ability of the oxidized wax to form optimum particle size is not impaired. Increases in gloss of over 300% may be obtained in this way. W. H. C.

Derived Chemical Products.

1838. Chemicals from Petroleum. Anon. *Industr. Chem.*, 1949, **25**, 392–399.—(See Abstract No. 1481.) E. B.

1839. Technical and Economic Comparison of Three German Industrial Processes for Buna Manufacture. A. Haehl. *Chim. et Ind.*, 1949, **62**, 254–264.—Butadiene was made from acetylene (obtained from carbide or from natural or synthesis methane by action of electric arc) through either 1 : 3- or 1 : 4-butylene-glycol. Schkopau, using carbide acetylene, had the simplest process with fewest by-products, Hüls had available a certain No. of by-products from the manufacture of acetylene from methane, both these works used the " 1–3 " synthesis. Ludwigshafen, using the " 1–4 " synthesis (Reppe process) yielded the greatest No. of by-products, the principal being propargyl alcohol, tetrahydrofurane, γ-butyrolactone and butine, butene, and butane diols. Such by-products may, under certain economic conditions, be of greater importance than the rubber produced. Reactions involved are depicted. V. B.

Coal, Shale, and Peat.

1840. Production of Liquid Fuels from Coal and Oil Shale. G. Roberts and P. R. Schultz. *Oil Gas J.*, 15.9.49, **48** (19), 116.—A study is presented of the technical and economic status of liq fuels from oil and shale, bringing up-to-date evaluations of these raw materials as potential replacements for crude petroleum.

Tables show raw-material requirements and products, investment per barrel per calendar day of equiv gasoline, raw-material cost at mine or well-head, cost of liq fuels expressed as cents per gal of equivalent gasoline, and comparative estimates of liq fuel costs. G. A. C.

1841. Liquefaction for Separating Hydrogen from Coke-oven Gas. P. Guillaumeron. *Chem. Engng*, 1949, **56** (7), 105–110.—Liquefaction technique is well known in Europe

for hydrogen separation. History of the process is followed by a discussion of theoretical considerations. Pretreatment of coke-oven gas is advantageous, and in some cases an essential precedent to liquefaction. Diagrammatic representation of the liquefaction process is included. The solution of lubrication problems and removal of water, acetylene, and liquid CH_4 is described. N_2 scrubbing is used to remove CO_2. In some cases where compressed H_2 is required, special design is incorporated to avoid the expansion of the separated H_2. R. G. T.

1842. Pyrolysis of Coal and Shale (Review). C. H. Prien. *Industr. Engng Chem.*, 1949, **41** (9), 1906–1911.—The review includes, besides literature concerned with coal and oil-shale pyrolysis, reference to corollary subjects related thereto, raw materials, products, and by-products of thermal decomposition, oven and retort equipment improvements, and analysis and testing procedures. Extensive bibliography. R. G. T.

Engines and Automotive Equipment.

1843. Engine Oil Testing in the States. Anon. *Gas Oil Pwr*, 1949, **44**, 247.—Tests for ring-sticking and piston-lacquer deposits are made on a four-stroke single cyl Caterpillar engine of cyl size 5¼ in dia and 8 in stroke, rated at 19·8 b.h.p. at 1000 r.p.m. The test is run for 480 hr, the oil being changed every 120 hr, with the oil and water temp held at 175° F. In general, a detergent additive is necessary, but the test can be passed without the use of oxidation inhibitors.

Tests for ring-sticking, piston deposits, and corrosion are made on a four-stroke, four-cyl Caterpillar engine of cyl dimensions 4½ by 5½ in. The rating is 37 b.h.p. at 1400 r.p.m., and the test occupies 120 hr. Since water and oil temperatures are higher than in the preceding test, an oxidation inhibitor is usually necessary.

The test for oxidn stability is run on a 6-cyl Chevrolet petrol engine at 30 b.h.p. and 3150 r.p.m. for 36 hr. Water temp is 209° F and oil temp 265° F.

The 500-hr General Motors test for detergency and oil stability is run on either the 3-71, 4-71, or 6-71 engines at full load and speed. The same oil is used throughout the test, but addition of make-up oil is permitted. In this test deposits occur in the intake ports, and control requires minimum oil consumption, which can be achieved only by keeping the oil-ring slots as clean as possible. For this a detergent is required, but its function is different to that in the preceding test.

The tests described are only a fraction of those usually employed. Engines of both petrol and diesel types run under a variety of conditions, including some in which the unit is purposely in poor condition or out of adjustment. H. C. E.

1844. Valve Port Design of Compression-Ignition Engines. C. B. Dicksee. *Nature*, 1949, **164**, 349.—A description is given of how the shape of the valve ports affects the volumetric efficiency of the C.I. engine. (Abstract of a paper read before the Inst. Mech. Engineers.) H. C. E.

1845. Mining and Petroleum Technique 3. Motor Compressor Unit for Oil Fields. Anon. *Ingenieur*, No. 29, 22.7.49, p.M. 29.—The paper gives a description of Thomassen natural-gas engines combined in unit with the compressor, the engine itself being of the Vee type, while the compressor section of the machine has a horizontal reciprocating motion. Reference is made to the advantages of pressure-lubrication systems, and a description is given of the safety mechanism which shuts down the machine when the oil pressure falls below a certain figure. R. R.

1846. English Electric Dual-Fuel Engines. Anon. *Gas Oil Pwr*, 1949, **44**, 229–234.—These engines have outputs ranging from 165 to 440 b.h.p. on gas, and are constructed in sizes from three to eight cyl of dimensions 10 in by 12 in. When running on gas, the quantity of fuel oil admitted by pilot injection can be varied between 3 and 8%, and the average combined fuel consumption at full load is *ca* 7150 B.Th.U. per b.h.p.hr. Under normal conditions the engine would stop if the gas supply failed, but in certain cases (*e.g.*, when engines are running in parallel) controls are so arranged that partial failure of the gas supply increases the oil supply immediately.

Tests on a three-cyl model developing 55 b.h.p. at 600 r.p.m. on the 12-hr rating are described.

The article contains eight figures and two tables. H. C. E.

1847. Diesel-Electric Power Plants. T. H. Carr. *Gas Oil Pwr*, 199, **44**, 239.—The advantages and disadvantages of the oil engine for use in small and medium power-plants are listed. The manner in which each diesel-alternator should be installed is described, together with a list of failures against which automatic warning should be provided. If diesel-alternators are to be operated in parallel a number of special conditions must be fulfilled. H. C. E.

1848. Special Engine for Petroleum Research. Anon. *Gas Oil Pwr*, 1949, **44**, 235–238.—This single-cyl engine, of which several are being made for testing diesel lubrications, can be fitted with almost any proprietory cyl block and head up to the limits of 4½-in bore and 6-in stroke. Other variable features are: two- or four-stroke cycle, spark or C.I., direct injection or separate combustion-chamber head, running speed up to 2500 r.p.m. and continuous rating of 2000 r.p.m.

Wear should not affect operating conditions in test runs of up to 500 hr duration. All auxiliary equipment is separated from the engine and is under the control of the operator. Lubrication of the various parts of the engine can be separated, and the piston can be removed in less than 4 min.

All instruments are grouped on a panel, and all auxiliary operations can be controlled from this point. The engine load can be adjusted to any desired setting, and is electronically controlled at that point. Devices are included which stop the engine if safe limits are exceeded. Fuel and oil consumption are measured by direct weighing, and the gas lost past the piston is measured by a blow-by meter. A special oscilloscope embodying two cathode-ray tubes enables four variables to be displayed simultaneously.

The article is illustrated by two photographs and three line diagrams.

H. C. E.

1849. Industrial Applications of the Gas Turbine. M. W. Woods and J. C. Wisdom. *J. Inst. Engrs (Australia)*, 1949, **21**, 67–76.—The gas turbine is discussed from a thermodynamical standpoint, and its advantages and disadvantages in relation to the various forms of propulsion are described. A section on the thermodynamics of the theoretical gas-turbine cycle is followed by a summary of reasons why departures from ideal conditions occur, and how these departures affect the specific output and efficiency. Modifications of the simple cycle improve the efficiency of the machine, but they add to its weight and thus are unsuitable for particular applications such as aircraft engines. Modifications which are discussed include: (*a*) provision of a heat exchanger; (*b*) carrying out the expansion or compression of the gases in more than one stage, with heating or cooling between stages; (*c*) closed- or semi-closed-cycle operation. Limitations on gas-turbine performance include: (*a*) the necessarily high temperatures of gas entering the turbine, which cause a continued slow deformation of stressed metal ("creep"); (*b*) ambient-air temperature, to which the turbine is very sensitive. Its efficiency decreases as temperature increases.

Comparisons of the gas turbine and other prime movers are made in respect of the following specific applications: power-stations, locomotive power-plant, marine power-plant, road vehicles, and in chemical engineering. The use of waste gases from oilfields, municipal garbage, etc., in the gas turbine is discussed. The concluding section deals with the use of different fuels in the gas turbine. For aircraft engines kerosine or petrol is used, whilst for industrial purposes the cruder and cheaper petroleum cuts are employed. Experiments have also been made on the construction of a coal-burning turbine. In choosing a suitable fuel the deleterious effect of corrosion, erosion, and blockage must be considered. H. C. E.

1850. A Danish Marine Gas Turbine. H. P. Christensen. *Motor Ship*, Oct. 1949, **30** (357), 281.—An account is given of the efforts made in Denmark after the war and the development of the gas turbine for industrial purposes. Details are given of an experimental unit which by now has had its first trials. I. G. B.

1851. The Development of Turbine Engines in France—III. Anon. *Airc. Engineering*, Oct. 1949, **21** (248), 328.—An account is given of some of the experimental work carried out by the research departments of the Société Rateau. This particular article deals with wind-tunnel cascade tests. I. G. B.

1852. 3415 Horsepower Group. Anon. *Aeroplane*, 30.9.49, **77** (1999), 482.—Technical details are given of the Napier Naiad coupled-propeller turbine. Estimated performance details are given showing variation of output and fuel consumption with the altitude under flight conditions and ICAN atmosphere. I. G. B.

MISCELLANEOUS.

1853. The Problem of Corrosion and its Prevention. Anon. *Mech. World*, 7.10.49, **126** (3273), 431.—Indirect losses through corrosion are known to be of a high order of magnitude. For example, over-design to allow for corrosion results in the needless consumption of appreciable tonnages of metal each year. Examples are quoted with reference to design of pipelines. It is also suggested that 60% of all automobile wear can be attributed to corrosion. To reduce these losses it is suggested that: (i) paints and metal coatings should be improved still more; (ii) employment of cathodic protection with or without use of external current; (iii) use of inhibitors to oil or fuel and use of corrosion-resistant alloys for cylinder-liners and piston-rings; (iv) control of environments, *e.g.*, humidity control; (v) use of packaging envelopes; (vi) use of deaerators to get rid of carbon dioxide, ammonia, and oxygen from the environment; (vii) introduction of small concn of some compound that stifles either the anodic or cathodic portions of normal corrosion reactions or both. A list is given of different inhibitors which can be used. A. S.

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

JANUARY, 1949.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

ANGEL, Norman Leslie, Engineering Abstractor, "Shell" Refining & Marketing Co. Ltd. (*C. D. Brewer ; L. F. Elsby*).

ARNOLD, Ernest Hockley, Factory Manager, Burmah-Shell Oil Storage and Distributing Co. of India Ltd.

BASU, Subhas Chandra, Assistant Electrical Engineer, General Electric Co. (India) Ltd.

DALE, Henry Lawley, Assistant Engineer, "Shell" Refining & Marketing Co. Ltd. (*N. Kendall ; C. D. Brewer*).

DAVIES, William Rupert, Assistant Engineer, Eagle Oil & Shipping Co. Ltd. (*E. J. Sturgess ; J. R. G. Barter*).

FARID, Mohamed Sami, Engineer and Technical Adviser, Shell Co. of Egypt Ltd. (*G. W. Thacker ; F. L. Garton*).

GUBBELS, Paul, Chief Chemist, Belgian Sun Oil Co. (*E. Stokoe*).

GULDEMOND, Pieter, Director, P. Guldemond PVBA. (*D. A. Brett ; E. Stokoe*).

HODGSON, George Collinson, Senior Maintenance Engineer, "Shell" Refining & Marketing Co. Ltd. (*E. Le Q. Herbert ; W. G. Gross*).

HORWICH, Otto Camillo, Chemist, Ragosine Oil Co. Ltd. (*G. Vineall ; J. C. Creech*).

JACKSON, John William, Field Superintendent, Anglo-Iranian Oil Co. Ltd. (*P. T. Cox*).

KELLY, Desmond Alymer Grattan, Fuel Engineer, Anglo-American Oil Co. Ltd. (*C. Chilvers ; W. Byrom*).

KING, Robert Augustin, Sales Process Engineer, E. B. Badger & Sons (Great Britain) Ltd. (*J. T. T. Robinson ; M. A. L. Banks*).

LARCOMBE, John George, Assistant Research Engineer, "Shell" Refining & Marketing Co. Ltd. (*C. D. Brewer ; N. Kendall*).

LE BAILLY, Louis Edward Stewart Holland, Student, The University, Birmingham.

MAJUMDAR, Manojkumar, Assistant Construction Engineer, The Burmah Oil Co. (I.C.) Ltd.

McDOUGALL, Alfred, Superintendent, Anglo-Iranian Oil Co. Ltd. (*M. A. L. Banks ; G. E. Wheeler*).

MORRIS, David Rowland, Student, Birmingham University. (*F. H. Garner*).

PARKINSON, Mark Mervyn Leofric, Field Superintendent, Trinidad Leaseholds Ltd. (*A. C. H. Thomas ; T. H. L. Tindall*).

PHILPOT, Stanley Hope, Analytical Chemist, Messrs. Hulse & Marshall. (*A. R. Read ; V. B. Wright*).

PORTEN, Ralph Charles, Group Cost Accountant, Manchester Oil Refinery Ltd. and Petrocarbon/Petrochemicals Ltd. (*E. J. Dunstan ; G. H. Harries*).

RAWLINSON, Daniel, Chemist, "Shell" Refining & Marketing Co. Ltd. (*D. Martin ; C. D. Brewer*).

RAY, Matthew David, Assistant Installation Manager, Shell-Mex & B. P. Ltd. (*N. E. Jones ; J. L. Black*).

ROGERSON, Clement Archer Adam, Area Engineer, Shell Petroleum Co. Ltd. (*E. J. Sturgess ; J. R. G. Barter*).

SCOTT, Ian, Chief Engineer, Oil Well Engineering Co. Ltd. (*E. G. Thorn ; L. S. Dawson*).

STAPLETON, Ronald Pearce, Manager, Messrs. Berry Wiggins & Co. Ltd. (*H. G. Spence ; R. C. Paterson*).

STENNING, Hartley Alan, Assistant Research Engineer, "Shell" Refining & Marketing Co. Ltd. (*N. Kendall ; C. D. Brewer*).

SUTHERLAND, Donald Alexander, Senior Refinery Operator, National Oil Pty. Ltd. (*B. A. Raper ; G. E. Mapstone*).

THOMPSON, Charles Norman, Lecturer, Liverpool City Technical College. (*A. J. Ham ; C. D. Brewer*).

TOWIE, Nicholas Rees, Assistant Petroleum Engineer, Anglo-Iranian Oil Co. Ltd. (*W. J. Baker*).

WHITEHEART, James Jesse, Fuel and Chemical Engineer, Morgan Crucible Co. Ltd. (*T. C. Bailey ; O. Wilding*).

WILCOX, James Dudley, Petroleum Technologist, Shell Co. of South Africa Ltd. (*I. H. G. Nicholson ; J. K. Sales*).

WILDBLOOD, Antony Barrs, Sales Representative, British Transformer Oil & Lubricants Ltd. (*E. J. Dunstan ; P. C. Masters*).

Transfers.

BILTON, Percy, Petroleum Technologist, Vigzol Oil Co. Ltd. (*W. H. Huxley*). (*Member to Fellow*).

HULL, Charles, Manager, Anglo-Egyptian Oilfields Ltd. (*J. A. Oriel ; H. Hyams*). (*Member to Fellow*).

MCCALLUM, Ian, Manager, Anglo-American Oil Co. Ltd. (*G. Noble ; C. R. Young*). (*Associate Member to Fellow*).

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

As Member

B. R. KAPOOR

As Fellows

ANDREWS, J. L.

DICKIE, R. K.

As Associate Fellows

ALDRICK, M. J.
CAMPBELL, G. S.
BURGESS, H. M.
CHEYNE, J. G.
EASTY, A. V.
GOODGER, E. M.
GREEN, A. J.
LATTER, R. W.
MACKENZIE, K. J.
RUSHWORTH, G. E.
RUTISHAUSER, L. F.
SCOPES, L.
TRAFFORD, E. LE M.
TURNER, R.

As Students

BEGG, A. J.
BILLINGTON, J.
HORTON, G. M. B.

As Member Companies

ENGLISH DRILLING EQUIPMENT CO. LTD.
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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

FEBRUARY, 1949.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

ANGUS, Archibald, Chief Distribution Engineer, Anglo-Iranian Oil Co. Ltd. (*G. E. Wheeler ; R. E. Adlington.*)

ANSDELL, Peter George, Industrial Sales Engineer, Anglo-American Oil Co. Ltd. (*W. E. J. Broom ; C. Chilvers.*)

ARMITT, Thomas Bertram, Student, Manchester College of Technology. (*G. Thornley ; T. C. Cragg.*)

ATKINSON, John, Senior Research Engineer, "Shell" Refining & Marketing Co. Ltd. (*C. D. Brewer ; E. T. Ault.*)

BRADBURY, Eric Wright, Terminal Co-ordinator, Cast and Operatives Dept., Anglo-American Oil Co. Ltd. (*C. Chilvers ; E. B. Evans.*)

BROOMAN, Andrew Stephen, Staff Training Officer, "Shell" Refining & Marketing Co. Ltd. (*F. Mackley ; J. G. Hancock.*)

CONEY, Leonard Herbert, Divisional Manager, Shell-Mex & B.P. Ltd. (*T. C. Bailey ; R. B. Southall.*)

DOYLE, Denis Elphick, Assistant in General Dept., Anglo-Iranian Oil Co. Ltd. (*A Chisholm ; T. W. Lane.*)

FLECK, Gerald Philip, Oilfield Trainee, Trinidad Petroleum Development Co. Ltd. (*C. Chilvers ; J. S. Collcott.*)

FLEMING, James, Partner, Fleming Brothers. (*A. Harland ; H. C. Blight.*)

FLORY, Sidney Albert, Research Assistant (Engineering), "Shell" Refining & Marketing Co. Ltd. (*F. Morton ; R. Sefton.*)

FRIEDLANDER, Gerhard, Chief Research Engineer, Industrial Research Co. Ltd. (*L. Grunberg ; A. H. Nissan.*)

FULTON, Clifford, Deputy Chief Distribution Engineer, Anglo-Iranian Oil Co. Ltd. (*G. E. Wheeler ; R. E. Adlington.*)

GEMMILL, John Smith, Assistant Mechanical Engineer, Anglo-Iranian Oil Co. Ltd. (*R. B. Southall ; H. Murphy.*)

GIBBS, Reginald Walter, Refinery Plant Supervisor, "Shell" Refining & Marketing Co. Ltd. (*H. W. Fleming ; E. J. Dawson.*)

HASLAM, Chris, Plant Superintendent, Lobitos Oilfields Ltd. (*J. S. Parker ; A. Cluer.*)

JOHNSTONE, Robert Edgeworth, Manager of Chemical Engineering Dept., The A.P.V. Co. Ltd. (*T. F. F. Robinson ; B. G. Banns.*)

LEWIN, Herbert Edgar, Deputy Manager, Lubricants Producers Ltd. (*J. E. M. Haslam ; E. J. Dunstan.*)

MATTHEWS, David Ernest, Chief Development Chemist, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley.*)

MAXWELL, Kennedy Moffat, Chemist, Technical Dept., Eagle Oil & Shipping Co. Ltd. (*R. G. Mitchell ; S. Hunn.*)

NUSSEY, John Theodore Menet, Technical Editor, "Shell" Refining & Marketing Co. Ltd. (*C. D. Brewer ; L. F. Elsby.*)

PICKERING, Harold, Technical Representative, Kenneth Thelwall Ltd. (*G. J. Vineall ; M. B. Holmes.*)

PINDER, Reginald John, Assistant Sales Manager (General), Anglo-American Oil Co. Ltd. (*C. Chilvers ; E. W. Hardiman.*)

RABSON, Henry Oswald, Stores Superintendent, Trinidad Petroleum Development Co. Ltd. (*C. Wilson ; J. S. Collcott.*)

RANDALL, David Geoffrey, Partner (Consulting Engineer), F. Heron Rogers (*F. H. Rogers ; H. T. Lorne.*)

RICKETTS, Alfred Herbert, Installation Manager, "Shell" Refining & Marketing Co. Ltd. (*F. Mackley ; J. G. Hancock.*)

SADLER, Edward Henry, Research Chemical Engineer, "Shell" Refining & Marketing Co. Ltd. (*D. Morten ; C. D. Brewer.*)

SIDERY, William Richard, Manager, Lubricants Producers Ltd. (*J. E. M. Haslam ; E. J. Dunstan.*)

TRACY, Arthur Horace Hanbury, Area Control, Anglo-Iranian Oil Co. Ltd. (*R. Tidy ; E. H. Ettlinger.*)

WEINSTEIN, Marcus Emanuel, Assistant Manager, Trade Relations Dept., "Shell-Mex" & B.P. Ltd. (*C. T. Brunner ; C. Chilvers.*)

WILLIAMSON, Ronald Ducat, Trainee Plant Chemist, "Shell" Refining & Marketing Co. Ltd. (*F. Mackley ; N. Kendall.*)

Transfers.

COLLCOTT, John Sanders, Oil Stocks Superintendent, Trinidad Petroleum Development Co. Ltd. (*S. F. M. Ault ; W. Gooday.*) (*Associate Member to Associate Fellow.*)

DEWHURST, John Desmond, Geologist, Burwali Oil Co. (*T. Dewhurst ; E. B. Evans.*) (*Student to Associate Fellow.*)

HIRST, William Parkinson, Chief Chemist, Shell Co. of South Africa Ltd. (*F. L. Garton ; H. Hyams.*) (*Associate Member to Fellow.*)

LOXLEY, Michael John, Combustion Research Engineer, Joseph Lucas Ltd. (*F. H. Garner ; A. E. Clarke.*) (*Student to Associate Fellow.*)

MCCARTHY, Wynford, Operator, Anglo-Iranian Oil Co. Ltd. (*R. B. Southall ; G. Surly.*) (*Student to Associate Fellow.*)

MEHTA, Ramkrishan Singh, Chemical Assistant, Fuel Research Institute, Dhanbad. (*A. Lahiri.*) (*Student to Associate Member.*)

NEILSON, Ian McIntosh, Engineer, Trinidad Petroleum Development Co. Ltd. (*C. Chilvers ; J. S. Collcott.*) (*Student to Associate Fellow.*)

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-Laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

PHILLIPS, H. RAIT, F. P.

As Fellow.

HYDE, J. W.

As Associate Fellows.

BEVAN, H. G. M.
BOYLE, D.
DRIVER, A. V.
EMERY, D. J.
HAWES, F.
HESLOP, D. J.
LACK, H. C.
MCLAUGHLIN, M. L.
MARTIN, F. W.
MOODY, R. E.
PANTER, F. A.
ROSS, W. C.
STEWART, F.
STINEAR, B. H.
WILSON, P. S.

As Associate Members.

Ballantyne, R. E. G.
Chir, V. J.
Goalen, G. K.
Hutchinson, S. C.
Innes, G. L.
Kemp, C. A.
Mackintosh, Miss C. F. M.
Pedrick, F. V.
Taylor, J. R.
Wheeler, L. J.

As Students.

Basker, G. R.
Betts, G. G.
Hugill, A. J.
Lee, G. A.
Makowsky, J.
Mohtadi, F.

As Member-Companies.

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The United Steel Companies Ltd.

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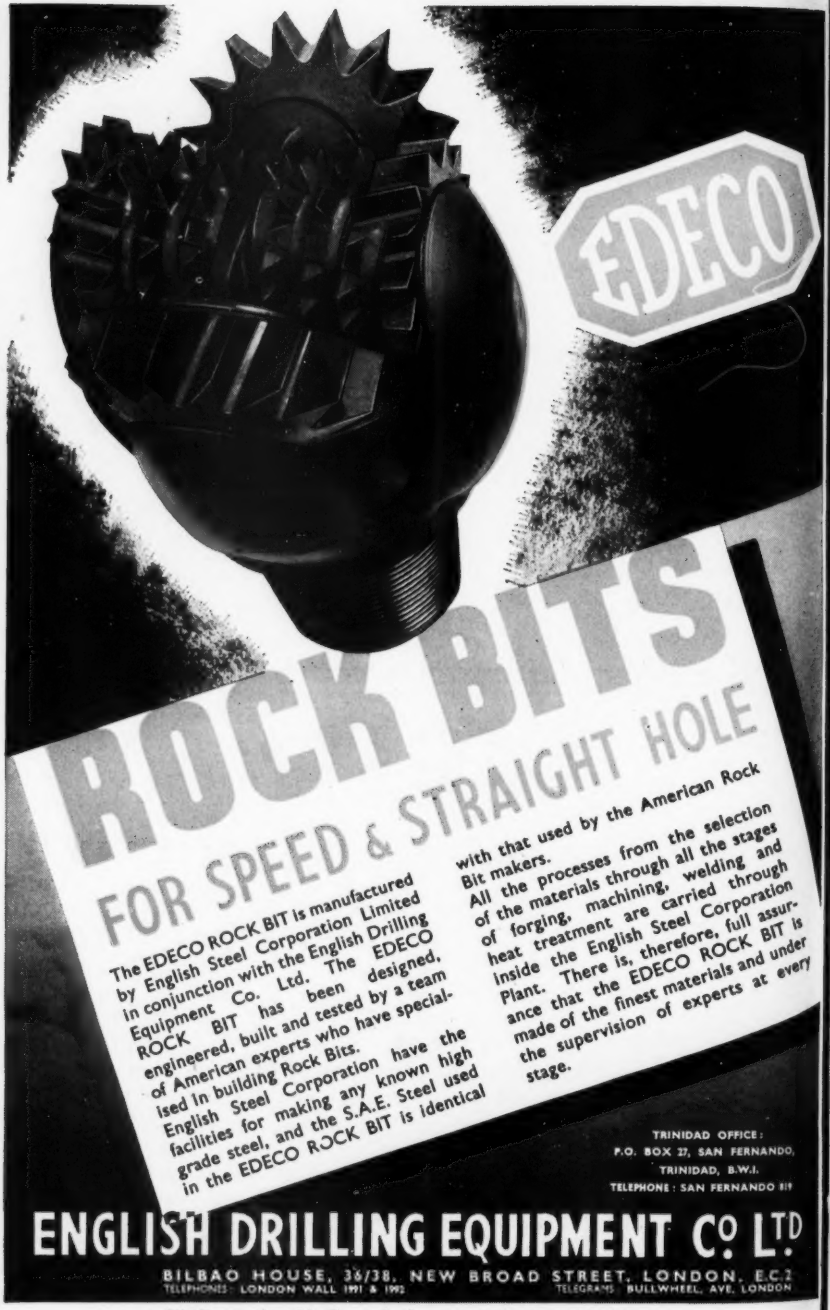
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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

MARCH, 1949.

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The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

ANNAS, Derek George, Laboratory Assistant, Petroleum Products (Lubricating Oils) Ltd. (*F. Dakin ; P. Kerr*).

BALLARD, Victor Lacey, Chief Clerk, " Shell " Refining & Marketing Co. Ltd. (*F. Brice ; J. G. Hancock*).

BRADFORD, Bernard William, Associate Research Manager, Imperial Chemical Industries Ltd. (*E. G. Brown ; P. Kerr*).

BURRASTON, Victor Trevor Charles, Chemist and Manager, Trier Bros. Ltd. (*R. B. Hobson ; G. Sell*).

CLAXTON, Godfrey, Research Chemist, National Benzole Co. Ltd. (*W. H. Hoffert ; W. H. Thomas*).

CRAIG, Thomas Hutchinson, Chief Engineer, Shell-Mex Argentina Ltd. (*G. C. Carr ; S. Hunn*).

DE PASS, Percy Harold Hamilton, Production Superintendent, Ecuador Oilfields Ltd. (*J. Burslem ; B. McL. Craig*).

FAKES, Neville Lewis, Technical Adviser, Shell Petroleum Co. Ltd. (*G. W. Thacker ; R. W. J. Smith*).

GARRETT, Kenneth Rupert, Chief Chemist, Calor Gas (Distributing) Co. Ltd. (*G. Kinner ; J. H. Putman*).

GOOSE, Eric Joseph Tunnard, Flight Lieutenant, Air Ministry (*J. Mason ; E. H. Jenkins*).

IRWIN, Charles Stuart Bonshaw, Commander of Motor Tanker, Metcalf Motor Coasters Ltd. (*A. F. Dabell*).

JENKINS, William Ernest, Director, Anglo-American Oil Co. Ltd. (*H. C. Tett ; C. Chilvers*).

JONES, Bryan Lloyd, Student, Royal School of Mines, London. (*S. E. Coomber ; G. D. Hobson*).

KAYE, Herbert, Process Superintendent, Manchester Oil Refinery Ltd. (*E. J. Dunstan ; J. Wood Mallock*).

LEWIS, Eric Albert, Chief Chemical Engineer, Wm. E. Farrer Ltd. (*N. D. Grey ; R. M. Ballantyne*).

MACLEAN, Alexander, Assistant Refinery Manager, Lobitos Oilfields Ltd. (*J. S. Parker ; A. Cluer*).

PILSBURY, Ronald William, Assistant Works Manager, C. C. Wakefield & Co. Ltd. (*G. H. Bromley ; L. Glendenning*).

RANDALL, Guy Littleton, Office Engineer, Cia de Petroleo Shell de Colombia. (*R. L. Lyne ; B. G. Andrews*).

STEIN, James, Assistant Supervisor, Esso Development Co. Ltd. (*A. Osborn ; A. J. S. Kenyon*).

STORY, Neil Vasey, Assistant Driller, Agha Jari Oilfields Ltd. (*W. Pennell ; L. J. Crook*).

VICKERY, David Sweetnam, Charge of Pilot Plants, Thornton Research Centre. (*D. Morten ; C. D. Brewer*).

WILKIE, Samuel Davies, Marine Superintendent, Standard-Vacuum Oil Co. (*A. W. Black ; W. G. Wright*).

WOOD, William Laurence, Head of Development Dept., British Petroleum Chemicals Ltd. (*D. G. Smith ; H. M. Stanley*).

Transfers.

BOSHELL, Ernest Gerard, Plant Superintendent, Lobitos Oilfields Ltd. (*V. Biske ; A. D. Makower*). (*Associate Member to Associate Fellow*).

COATES, Joseph, Senior Geologist, Burmah Oil Co. Ltd. (*T. Dewhurst ; P. Evans*). (*Associate Member to Fellow*).

DOUGLAS, Robert Tertius, Assistant Refinery Superintendent, Lobitos Oilfields Ltd. (*A. Cluer ; V. Biske*). (*Associate Member to Associate Fellow*).

FORREST, Archibald John, Major R.A. (*J. S. Parker ; A. Cluer*). (*Associate Member to Member*).

GOSSLING, Percy William Lingley, Assistant Chief Chemist, C. C. Wakefield & Co. Ltd. (*E. A. Evans ; G. H. Bromley*). (*Member to Fellow*).

HARKESS, John Mackay, Research Chemist, Lobitos Oilfields Ltd. (*V. Biske ; M. Ingram*). (*Member to Fellow*).

HOBSON, Richmond Barlow, Chief Chemist, Pressure Lubricants Ltd. (*E. R. Redgrove ; G. G. Grant*). (*Associate Member to Fellow*).

WILLIAMS, Stanley John, Process Operator, Anglo-Iranian Oil Co. Ltd. (*E. Thornton ; R. B. Southall*). (*Student to Associate Fellow*).

WRIGHT, Ernest Peter, Research and Development Engineer, Regent Oil Co. Ltd. (*F. Morton ; F. H. Garner*). (*Student to Associate Fellow*).

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

CONEY, L. H.
PINDER, R. J.
RICKETTS, A. H.
SIDERY, W. R.

As Fellows.

HIRST, W. P.
MATTHEWS, D. E.

As Associate Members.

BRADBURY, E. W.
DOYLE, D. E.
FLECK, G. P.
LEWIN, H. E.
PICKERING, H.
RABSON, H. O.

As Associate Fellows.

ARMITT, T. B.
ATKINSON, J.
BROOMAN, A. S.
COLLCOTT, J. S.
DEWHURST, J. D.
FLORY, S. A.
FRIEDLANDER, G.
GIBBS, R. W.
HASLAM, C.
JOHNSTONE, R. E.
LOXLEY, M. J.
MAXWELL, K. M.
MCCARTHY, W.
NEILSON, I. M.
NUSSEY, J. T. N.
RANDALL, D. G.
SADLER, E. H.
TRACY, A. H. H.
WILLIAMSON, R. D.

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MESSRS. KENNETH THELWALL LTD.
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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

APRIL, 1949.

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The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

ALLEN, Fraser Hall, Division Reservoir Engineer, Stanolind Oil & Gas Co. (*G. H. Fancher ; E. De Golyer.*)

ARNOLD, Henry Rogers, General Manager, Socony-Vacuum Oil Co. Inc. (*A. L. McColl ; S. J. M. Auld.*)

ASHLEY, Edward John, Research Engineer, Snowdon Sons & Co. Ltd. (*E. R. Redgrove ; J. E. James.*)

ASTRUP, Maurice Eivind, Installation Manager, Cleveland Petroleum Co. Ltd. (*S. J. W. Pleeth ;* G. Sell.)

ATTWOOD, Edmund, Technical Representative, Fina Petroleum Products Ltd. (*D. M. Glendinning ; S. Hunn.*)

BARWELL, Frederick Thomas, Senior Principal Scientific Officer, National Physical Laboratory (Mechanical Engineering Research). (*C. D. Brewer , D. Clayton.*)

BELLIS, Albert James Lanceley, Junior Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*W. A. Laverick ; H. W. Fleming.*)

DARBYSHIRE, Bernard Norman, Business Manager, Harold Moore & Partners. (*H. Moore ; P. H. Moore.*)

DAVIES, Gwynfryn, Assistant Process Section Superintendent, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Morley.*)

DEAL, John Leonard, Technical Assistant, Trinidad Leaseholds Ltd. (*H. W. Macnaughton-Jones ; A. L. Down.*)

DOWNS, Diarmuid, Research Engineer, Ricardo & Co. Eng. (1927) Ltd. (*F. L. Garton ; S. R. Hills.*)

DURRAN, Roy Victor, Chief Draughtsman, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Morley.*)

FOWLER, Walter, Chief Assistant Chemist, C. C. Wakefield & Co. Ltd. (*G. H. Thornley ; J. C. Cragg.*)

GRIDLEY, John Crandon, Chairman, Vacuum Oil Co. Ltd. (*A. L. McColl ; H. Hyams.*)

HILTON, Jack, Chemist, Ernest Newton & Co. Ltd. (*E. J. Newton ; P. Snow.*)

HOBSON, Cecil Davidson, Production Engineer, Apex (Trinidad) Oilfields Ltd. (*S. M. Reid ; H. C. Costelloe.*)

HUGGETT, Walter Edward, Chief Chemist, Manchester Oil Refinery Ltd. (*E. J. Dunstan ; H. E. Charlton.*)

IRONSIDE, John McLaren, Assistant Superintendent, Trinidad Leaseholds Ltd. (*H. W. Macnaughton-Jones ; A. L. Down.*)

LAWRIE, Charles, Company Director, Vacuum Oil Co. Ltd. (*S. J. M. Auld ; A. L. McColl.*)

MCKINNON, Malcolm McFarlane, Maintenance Engineer, "Shell" Refining & Marketing Co. Ltd. (*N. Kendall ; J. G. Hancock.*)

MELLEN, Kenneth, Junior Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*W. A. Laverick ; H. W. Fleming.*)

MORSE, Walter Louis Ernest, Production Trainee, Sarawak Oilfields Ltd. (*C. R. Middleton ; C. H. Hall.*)

NUTTALL, John Marcus, Works Chemist, Thos. Moscrop & Co. Ltd. (*G. H. D. Holmes ; M. H. Davies.*)

OXAAL, Johan Fredrik Brandt, Chemist, Norsk Broendesclolje A/s. (*W. H. Thomas ; A. R. Javes.*)

PUCKEY, Jack Vernon, Assistant Geologist, Trinidad Petroleum Development Co. (*C. Wilson ; J. S. Collcott.*)

PRIMMER, Edward Richard John, Senior Clerk, Shell Petroleum Co. Ltd. (*H. de Wilde ; J. M. Penney.*)

RAY, Suresh Prasad, Chemist, Balmer Lawrie & Co. Ltd. (*C. W. J. Biddolph ; G. Sell.*)

ROBERTS, Harold Louis, Fire Marshal, Trinidad Leaseholds Ltd. (*A. L. Down ; N. R. Pocock.*)

RUDKIN, Arthur, Works Manager, John L. Seaton & Co. Ltd. (*G. E. Gray ; H. L. Bowman.*)

STEIN, Herbert K., Law Officer, Shell-Mex & B.P. Ltd. (*H. Hyams ; J. W. Vincent.*)

THOMAS, Derek, Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*W. H. Laverick ; H. W. Fleming.*)

TIDBURY, Kenneth Mark, Engineering Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*W. H. Laverick ; H. W. Fleming.*)

TOYE, Raymond Christopher Hatton, Advisory Administrator, Shell Group. (*H. Hyams ; E. LeQ. Herbert.*)

VENIS, Reginald Jeremiah, Plant Designer, Petrocarbon Ltd. (*E. J. Dunstan ; V. Biske.*)

WALKER, Arthur Edward, Engineering Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*W. A. Laverick ; H. W. Fleming.*)

WALKER, Wilfrid Seymour, Manager, Anglo-Iranian Oil Co. Ltd. (*D. Whyte ; G. H. Coxon.*)

WARNER, Francis Banks, Manager, Fina Petroleum Products Ltd. (*C. T. Brunner ; E. A. Evans.*)

WELLINGTON, Charles Thomas, Operating and Administrative Assistant to Chief Engineer, Anglo-Mexican Petroleum Co. Ltd. (*G. C. Carr ; R. G. Mitchell.*)

WRIGHT, Leslie Edmund Pearce, Technical Manager, Price's Lubricants Ltd. (*C. E. Mold ; K. E. W. Ridler.*)

Transfers.

BLANE, Edward Richardson, Assistant Technologist, Vacuum Oil Co. Ltd. (*S. J. M. Auld ; E. E. Turner*) (*Member to Fellow.*)

ELLIS, Eric George, Laboratory Superintendent, Vacuum Oil Co. Ltd. (*S. J. M. Auld ; E. E. Turner*) (*Member to Fellow.*)

HILTON, John Sydney, Manager, Belgrave Oil & Grease Co. (Leeds) Ltd. (*S. S. Bush ; G. Sell*) (*Student to Associate Member.*)

GLENDINNING, Leslie, Chemist, C. C. Wakefield & Co. Ltd. (*G. H. Thornley ; J. C. Cragg*) (*Associate Member to Associate Fellow.*)

SCHMITZ, Pierre, Marie Edmond, Technical and Scientific Manager, Petrofine-Brussels. (*V. Biske*) (*Member to Fellow.*)

THOMAS, William Rawlings, Assistant Operator, Anglo-Iranian Oil Co. Ltd. (*E. Thornton ; E. Squire*) (*Student to Associate Fellow.*)

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

ANGUS, A.	FLEMING, J.	JENKINS, W. E.
CRAIG, T. H.	FULTON, C.	WEINSTEIN, M. E.

As Fellows.

BRADFORD, B. W.
COATES, J.
GOSSLING, P. W. L.
MACLEAN, A.
WOOD, W. L.

As Associate Members.

ANSDELL, P. J.
BALLARD, V. L.
GEMMILL, J. S.
IRWIN, C. S. B.
PASS, P. N. H. DE
PILSBURY, R. W.
WILKIE, S. D.

As Associate Fellows.

BOSHELL, E. G.
BURRASTON, V. T. C.
CLAXTON, G.
DOUGLAS, R. T.
FAKES, N. L.
GARRETT, K. R.
GOOSE, E. J. T.
KAYE, H.
RANDALL, G. L.
STFIN, J.
STORY, N. V.
VICKERY, D. S.
WILLIAMS, S. J.
WRIGHT, E. P.

As Member Companies.

MESSRS. ARTHUR BROWN & CO. LTD.
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THE DOMINION MOTOR SPIRIT CO.
MESSRS. DUSSEK BROTHERS LTD.
MESSRS. FLEMING BROTHERS.
MESSRS. GAUNT & HICKMAN LTD.
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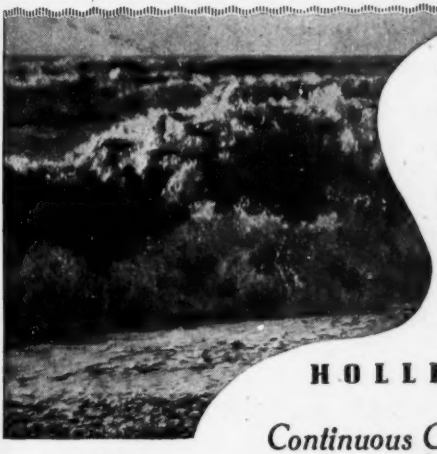

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

MAY, 1949.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

BROWN, Donald William, Metallurgist, Morgan Crucible Co. Ltd. (*T. C. Bailey ; J. J. Whiteheart.*)

CROCKFORD, Allen Leslie, Student, Camborne School of Mines.

DOULTON, Peter Duke, Director and Manager, Matthew Hall & Co. Ltd. (*G. Elias ; R. H. Dodd.*)

DREW, John Hardy, General Assistant, Esso Transportation Co. Ltd. (*E. Evans-Jones ; B. Collins.*)

ELLIOTT, Gilbert Drury, Company Director, John Thompson Water Tube Boiler Co.

GRIFFITHS, Thomas Leslie, Cashier, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley.*)

HARMAR-BROWN, Francis Millington Sturge, Assistant Director, Manchester Oil Refinery and Petrochemicals Ltd. (*W. G. Humphreys ; H. Thurhill.*)

KING, John Willis, Director, Jacobs and Partners Ltd. (*C. Seers ; C. W. G. Martin.*)

LINES, Dean Franc, Trainee, Sarawak Oilfields Ltd. (*G. F. Hazzard ; C. R. Middleton.*)

LUBBOCK, Isaac, Mechanical Engineer, Shell Petroleum Co. Ltd. (*J. A. Oriel ; H. Hyams.*)

MARSDEN, Edgar Gabriel, Technical Assistant, Trinidad Leaseholds Ltd. (*H. Macnaughton-Jones ; A. Down.*)

MATTHEWS, Marcus Aurelius, Chief of Planning Division, Shell Petroleum Co. Ltd. (*F. H. Braybrook ; H. N. Short.*)

OLDKNOW, Leonard James Arthur, Administrative Assistant, London County Council. (*J. A. Ainsworth ; S. S. Burgess.*)

PENN, Charles James, President, International Oil Co.

POTTS, Norman Tristram, Inspecting Engineer, Shell Petroleum Co. Ltd. (*S. L. Witard ; G. Sell.*)

REID, Robert Curle MacKellar, Agent, Freedom-Valvoline Oil Co. (*J. M. Marshall ; H. Healey.*)

SCHOFIELD, Henry Beaumont, Petroleum Production Engineer, Burmah Oil Co. Ltd. (*H. C. Carter ; B. Nisbet.*)

SMITH, Vernon Frederick Stimson, Chemist, Shell-Mex & B.P. Ltd. (*A. E. Hope ; A. W. Richardson.*)

SUMNER-ANDREWS, William Edward, Assistant Engineer, Trinidad Leaseholds Ltd. (*E. J. U. Tait ; A. Down.*)

THURLAND, Francis Edward, Technical Assistant, Trinidad Leaseholds Ltd. (*H. Macnaughton-Jones ; A. Down.*)

WEBB, Arthur, Analytical Chemist, British Waxed Wrappings Ltd. (*P. Kerr ; G. Sell.*)

WILLIS, Percy George, Engineer in Charge, Shell-Mex & B.P. Ltd. (*F. Green ; T. T. Davies.*)

Transfers.

BOON, Cyril Bertrand, Chief Chemist, Germ Lubricants Ltd. (*J. W. Southcombe ; G. H. Harries.*) (*Transfer from Associate Member to Fellow.*)

BOWES, Emmerson, Research Chemist, Lobitos Oilfields Ltd. (*V. Biske ; A. D. Makower.*) (*Student to Associate Fellow.*)

HUTT, Eric Tom, Senior Research Engineer, Shell Refining & Marketing Co. Ltd. (*C. D. Brewer ; J. Atkinson.*) (*Associate Member to Associate Fellow.*)

MORRISON, Joseph Allison, Materials Engineer, Shell Refining & Marketing Co. Ltd. (*B. S. Brailey ; W. G. Gross.*) (*Member to Fellow.*)

ROBINSON, Eric Scott, Chemist, Shell-Mex & B.P. Ltd. (*F. Green ; F. Lazzell.*) (*Student to Associate Fellow.*)
SEFTON, Ronald, Chemist, Regent Oil Co. Ltd. (*T. K. Hanson ; J. Mason.*) (*Associate Member to Fellow.*)
WHEELER, Roy, Petroleum Exploitation Engineer, Sarawak Oilfields Ltd. (*S. E. Coomber ; G. Sell.*) (*Student to Associate Fellow.*)

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-Laws.
Elections are subject to confirmation in accordance with the By-laws.

As Members.

ARNOLD, H. R.
FORREST, A. J.
GRIDLEY, J. C.
LAWRIE, C.
STEIN, H. K.
TOYE, R. C. H.
WALKER, W. S.
WARNER, F. B.

As Fellows.

HOBSON, R. B.
HUGGETT, W. E.

Transfer to Fellows.

ELLIS, E. G.
SCHMITZ, P. M. E.

As Associate Members.

ASTRUP, M. E.
ATTWOOD, E.
DARBYSHIRE, B. N.
HOBSON, C. D.
LEWIS, E. A.
PRIMMER, E. R. J.
ROBERTS, H. L.

Transfer to Associate Members.

HILTON, J. S.
MEHTA, R. S.

As Associate Fellows.

ALLEN, F. H.
ASHLEY, E. J.
BARWELL, F. T.
DAVIES, G.
DEAL, J. L.
DOWNS, D.
DURRAN, R. V.
FOWLER, W.
HILTON, J.
IRONSIDE, J. M.
MCKINNON, M. M.
MORSE, W. L. E.
NUTTALL, J. M.
OXAAL, J. F. B.
RAY, S. P.
RUDKIN, A.
THOMAS, D.
TIDBURY, K. M.
VENIS, R. J.
WALKER, A. E.
WRIGHT, L. P. E.

Transfers to Associate Fellows.

GLENDINNING, L.
THOMAS, W. R.

As Students.

BELLIS, A. J. L.
MELLEN, K.
PUCKEY, J. V.

As Member Companies.

MESSRS. DANIEL ADAMSON & CO. LTD.
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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

JUNE 1949.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

BROOK-HART, Denys, Director of Public Relations, Manchester Oil Refinery Ltd. (*E. J. Dunstan ; G. Sell.*)

COPPENS, Jan Frans Celina, Chief Chemist, Transport & Trading Co. Ltd. (*D. J. W. Kreulen ; E. Stokoe.*)

DEPAUW, Claude Achille Lucien, Chemist, L'Alliance Soc. Anon. (*E. Stokoe ; J. Lenaerts.*)

DOWNS, Joan Margaret, Junior Chemist, Regent Oil Co. Ltd. (*F. Morton ; E. M. Tanner.*)

GREER, Edward Marshall, Industrial Chemist, Anglo-Iranian Oil Co. Ltd. (*E. Squire ; E. J. Horley.*)

GROCOTT, Peter Colin, Assistant Sales Engineer, Alex. Duckham & Co. Ltd. (*J. S. Jackson ; P. Driver.*)

HENRY, Powell Robert, Technical Director, Griffin & Tatlock Ltd. (*P. Kerr ; G. Sell.*)

LAWSON, Arthur Edwin, Chief Engineer, Fletcher Miller Ltd. (*N. G. Gullick ; E. G. White.*)

MONCRIEFF-YEATES, Alexander John, Research Physicist, Trinidad Leaseholds Ltd. (*R. Sefton ; E. M. Tanner.*)

OWTRAM, Thomas Cary, Assistant Manager, Shell Petroleum Co. Ltd. (*H. Hyams ; G. Sell.*)

PARRY, George Alwyn, Chief Engineer, "Shell" Refining & Marketing Co. Ltd. (*P. M. Griffiths ; F. H. Garner.*)

SARJEANT, Ralph Lionel, Assistant Engineer, Shell Petroleum Co. Ltd. (*E. J. Sturgess ; J. R. G. Barter.*)

STEWART, Daniel, Deputy Chief Chemist, Scottish Oils Ltd. (*R. Crichton ; G. H. Smith.*)

STIRLING, William Mackenzie, Assistant Chief Electrical Engineer, Scottish Oils Ltd. (*R. Crichton ; G. H. Smith.*)

STOCKS, John Rendel, Assistant Director of Research, "Shell" Refining & Marketing Co. Ltd. (*C. D. Brewer ; C. S. Williams.*)

TAYLOR, Harry, Assistant Electrical Engineer, Iraq Petroleum Co. Ltd.

USHER, John Benjamin, Analytical Chemist, Co-operative Society Ltd. (*H. S. Williamson ; A. R. Williamson.*)

Transfers.

BARANY, George Martin, Chemical Engineer, Manchester Oil Refinery Ltd. *F. H. Garner ; A. H. Nissan.*)

CROOK, Roy Dallas, Assistant Refinery Manager, Anglo-Egyptian Oilfields Ltd. (*C. Hull ; H. Hyams.*)

GOTTESMANN, Manfred, Representative-Distributor, Petrochemicals Ltd. (*P. H. Frankel.*)

KEMPTON, William John Horell, Electrical Oils Chemist, Silvertown Lubricants Ltd. (*H. Marshall ; A. F. Goodwin.*)

KENYON, Arthur James Frederick, Laboratory Supervisor, Anglo-American Oil Co. Ltd. (*A. Osborn ; K. Arter.*)

OVER, John Robert, Chemical Engineer, Midland Tar Distillers Ltd. (*F. H. Garner ; R. Scott.*)

ROBERTS, Leonard Riley, Company Director, The Dee Oil Co. Ltd. (*G. H. Coxon ; G. Sell.*)

WHIPP, Roger Henry, Squadron Leader, Royal Air Force. (*J. Mason ; L. Bevan.*)

ERRATUM.

The list of applications for membership published in the April 1949 issue of the *Journal* incorrectly described MR W. E. HUGGETT as Chief Chemist of Manchester Oil Refinery Ltd. Actually, Mr Huggett is Chief Chemist of Petrochemicals Ltd.

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

DOULTON, P. D.
ELLIOTT, G. D.
KING, J. W.
WELLINGTON, C. T.

As Fellows.

LUBBOCK, I.
MATTHEWS, M. A.
SEFTON, R.

As Associate Members.

BROWN, D. W.
GRIFFITHS, T. L.
HARMER-BROWN, F. M. S.
OLDKNOW, L. J. A.
PENN, C. J.
REID, R. C. M.

As Associate Fellows.

BOON, C. B.
BOWES, E.
HUTT, E. T.
LINES, D. F.
MARSDEN, E. G.
POTTS, N. T.
ROBINSON, E. S.
SCHOFIELD, H. B.
SMITH, V. F. S.
SUMNER-ANDREWS, W. E.
THURLAND, F. E.
WEBB, A.
WHEELER, R.
WILLIS, P. G.

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

JULY 1949.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

CLAYTON-GREENE, Clare Freeman, Assistant Works Supervisor, Rimer Bros. Ltd. (*A. C. Michie ; E. A. Evans.*)

JOHNSON, Eric Keith, Student, Birmingham University. (*F. H. Garner ; F. Morton.*)

LA TROBE-BATEMAN, John Saumarez, Manager, Shell Petroleum Co. Ltd. (*J. A. Oriel ; C. F. Jackson.*)

MCALPINE, William Edward, Salesman, Lubricating Fuel Oils Ltd. (*T. G. Provest ; M. Mason.*)

MELVILLE, George, Civil Engineer, Shell Petroleum Co. Ltd. (*C. F. Jackson ; P. G. Higgs.*)

PAUL, Peter Ferguson Maclachlan, Post-Graduate Research Student, Dyson Perrins Laboratory, Oxford University. (*J. C. Smith ; G. Sell.*)

PIKETT, John Robert, Technical Consultant, Area Petroleum Office, U.S. Navy. (*J. Mason ; L. Bevan.*)

PUNSHI, Suraj K., Research Scholar, Government of India. (*W. M. Cummings ; G. Sell.*)

RITCHIE, Gordon Ogle, Technical Representative, Shell-Mex & B.P. Ltd. (*H. M. Short ; H. E. Linden.*)

ROLLO, David Norman Burton, Fitter and Turner, Wilson Bros. Pipe Fittings Ltd. (*A. Barker ; E. Wilson.*)

SPARKS, Herbert George, Petroleum Quality Control Officer, Air Command, Far East. (*J. Mason ; L. Bevan.*)

TURNER, Bernard Evelyn Boileau, Supervisor, Shell-Mex & B.P. Ltd. (*H. E. Priston ; G. S. Everist.*)

WOOD, Sheila Emily, Assistant Chemist, Regent Oil Co. Ltd. (*G. C. Pearson ; C. Sefton.*)

Transfers.

BOESE, Alan Charles, Petroleum Engineer, Anglo-Iranian Oil Co. Ltd. (*F. H. Garner ; J. F. Waters.*) (*Student to Associate Member.*)

DODD, Robert Henry, General Manager, Lummus Co. (*J. A. Oriel ; J. W. Vincent.*) (*Associate Fellow to Fellow.*)

JENNISON, John Anthony, Plant Progress Control Chemist, Manchester Oil Refinery Ltd. (*E. J. Dunstan ; G. H. Harries.*) (*Associate Member to Associate Fellow.*)

PEARSON, Peter Dennis, Exploitation Engineer (Trainee), United British Oilfields of Trinidad Ltd. (*P. A. Taylor ; F. C. Hamilton.*) (*Student to Associate Fellow.*)

WITHERS, John Granville, Deputy Head of Engine Research Station, Anglo-Iranian Oil Co. Ltd. (*R. Stansfield ; W. H. Thomas.*) (*Associate Member to Fellow.*)

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

DOULTON, P.D.
ELLIOTT, G. D.
KING, J. W.
WELLINGTON, C. T.

As Fellows.

LUBBOCK, I.
MATTHEWS, M.A.
SEFTON, R.

As Associate Fellows.

BOON, C. B.
BOWES, E.
HUTT, E. T.
LINES, D. F.
MARSDEN, E. G.
POTTS, N. T.
ROBINSON, E. S.
SCHOFIELD, H. B.
SMITH, V. F. S.
SUMNER-ANDREWS, W. E.
THURLAND, F. E.
WEBB, A.
WHEELER, R.
WILLIS, P. G.

As Associate Members.

BROWN, D. W.
GRIFFITHS, T. L.
HARMER-BROWN, F. M. S.
OLDKNOW, L. J. A.
PENN, C. J.
REID, R. C. M.

As Member Companies.

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THE PYRENE COMPANY LIMITED.
MESSRS. SYDNEY SMITH & SONS LTD. (NOTTINGHAM).
MESSRS. WATSONS PETROL DIST. LTD.
MESSRS. WILLIAM WALKER & SONS (HANLEY) LTD.

NEW MEMBERS.

AUGUST 1949.

The following elections have been made by the Council in accordance with the By-Laws.

Elections are subject to confirmation in accordance with the By-Laws.

As Member.

LA TROBE-BATEMAN, J. S.

Transferred from Member to Fellow.

BLANE, E. R.

Transferred from Associate Members to Fellows.

DODD, R. H.
WITHERS, J. G.

As Associate Members.

CLAYTON-GREENE, C. F.
MCALPINE, W. E.
RITCHIE, G. O.
TURNER, B. E. B.

Transferred from Student to Associate Member.

BOESE, A. C.

As Associate Fellows.

MELVILLE, G.
PAUL, P. F. M.
PUNSHI, S. K.
SPARKS, H. G.
USHER, J. B.

Transferred from Associate Member to Associate Fellow.

JENNISON, J. A.

Transferred from Student to Associate Fellow.

PEARSON, P. D.

As Students.

JOHNSON, E. K.
ROLLO, D. N. B.
WOOD, S. E.

As Member Companies.

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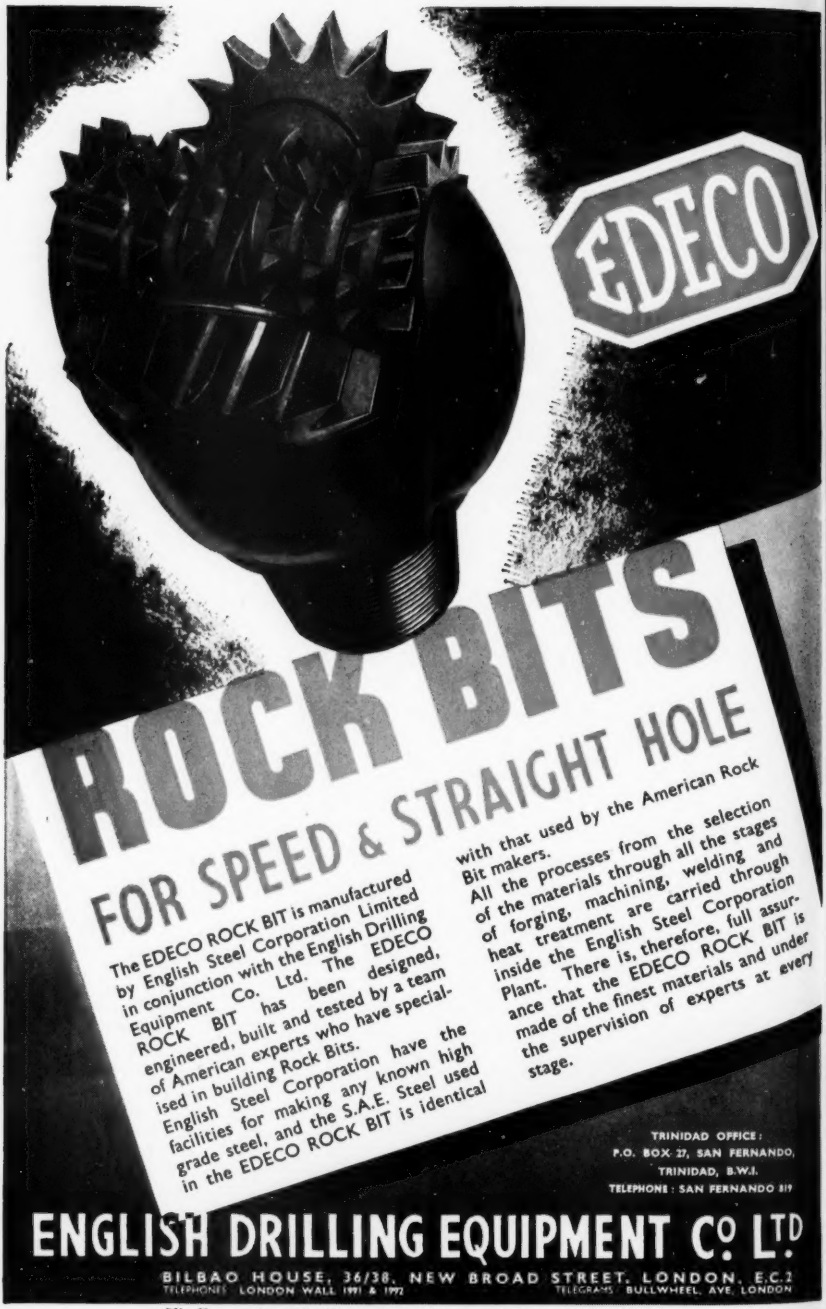
MESSRS. DAVEY, PAXMAN & CO. LTD.
MESSRS. SHAW PETRIE LTD.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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

SEPTEMBER, 1949.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

BARKER, Reginald Graham, Deputy Managing Director, William Barker Junr. & Co. Ltd. (*H. H. Ballard ; H. E. Brown.*)

BATEMAN, Ernest Leonard, London Production Department, Shell Petroleum Co. Ltd. (*H. Hyams ; P. M. De Veulle.*)

BECKER, Henry Edward, Department Head, Anglo-Saxon Petroleum Co. Ltd. (*P. M. De Veulle ; D. King Farlow.*)

BOOTH, Samuel James, Section Head, Production Dept., Anglo-Saxon Petroleum Co. Ltd. (*P. M. De Veulle ; D. King Farlow.*)

BROWN, Charles Clover, Assistant Manager, Shell Petroleum Co. Ltd. (*L. G. Gabriel ; H. Hyams.*)

BUSCOMBE, John, Assistant to Manager, Shell Petroleum Co. Ltd. (*C. Hull ; H. Hyams.*)

CATTRALL, Walter, Section Head, Production Dept., Anglo-Saxon Petroleum Co. Ltd. (*P. M. De Veulle ; H. Hyams.*)

CHAPMAN, Cyril Henry, Administration Officer, Shell Petroleum Co. Ltd. (*C. Hull ; H. Hyams.*)

CLARKE, John Henry, Manager, Shell Petroleum Co. Ltd. (*J. A. Oriel ; J. W. Vincent.*)

DAVIDSON, Ian Douglas, Manager, Production Dept., Shell Petroleum Co. Ltd. (*J. A. Oriel ; E. LeQ. Herbert.*)

GLERUM, Mathys Joost, Chief Draughtsman, United British Oilfields of Trinidad Ltd. (*F. C. Hamilton ; R. A. Taylor.*)

GODBER, Samuel Gordon, Assistant Manager, Anglo-Saxon Petroleum Co. Ltd. (*C. Hull ; H. Hyams.*)

GRANT, Richard Brodrick, Section Head, Anglo-Saxon Petroleum Co. Ltd. (*P. M. De Veulle ; D. King Farlow.*)

HOOK, Cyril Curtis, Section Head, Production Dept., Anglo-Saxon Petroleum Co. Ltd. (*H. Hyams ; P. M. De Veulle.*)

HOPKINS, John Goddard, Manager, Production Dept., "Shell" Refining & Marketing Co. Ltd. (*F. L. Garton ; H. Hyams.*)

JEFFERSON, Stanley Francis, Section Head, Production Dept., Shell Petroleum Co. Ltd. (*C. Hull ; H. Hyams.*)

KETZER, Paul A., Engineer, Societe Commerciale des Products du Petrole, Paris. (*J. L. E. Groff ; F. Beazley.*)

KNOX, Alexander McLean, Installation Manager, Shell Petroleum Co. Ltd. (*J. A. Davis ; H. A. Blackmore.*)

MACLEOD-CAREY, Cecil Rupert Alan, Technical Engineer, The Regent Oil Co. Ltd. (*N. E. Gullick ; W. A. Webster.*)

NAYLOR, Leslie Herbert, Section Head, Production Dept., Anglo-Saxon Petroleum Co. Ltd. (*H. Hyams ; P. M. De Veulle.*)

PAMPLIN, George Edward, Laboratory Assistant, Shell-Mex and B.P. Ltd. (*F. N. Harrap ; G. L. Coles.*)

PEBERDY, Ernest Frederick William, Petroleum Engineer, 3 Base Petroleum Installation. (*P. Holmes ; E. A. L. Francis.*)

PICKETT, Harry Leonard Robertshaw, Assistant to Manager, Anglo-Saxon Petroleum Co. Ltd. (*H. Hyams ; P. M. De Veulle.*)

PUMMELL, Horace James, Section Head, Production Dept., Anglo-Saxon Petroleum Co. Ltd. (*D. King Farlow ; P. M. De Veulle.*)

RATCLIFFE, Wilfred Fitzgerald, Engineering Assistant, Shell Petroleum Co. Ltd. (*E. J. Sturgess ; D. R. Howgill.*)

RAY, Bhupendra Nath, Student, University College.

REID, George Lowe, Manager, Anglo-Saxon Petroleum Co. Ltd. (*J. A. Oriel ; H. Hyams.*)

RIPPINGALE, Frederick Lionel, Section Head, Shell Petroleum Co. Ltd. (*C. Hull ; H. Hyams.*)

ROGERS, Percy Henry Ralph, Terminal Inspector, Anglo-American Oil Co. Ltd. (*P. Low ; W. Woodrow.*)

SANSOM, Frank Edward, Section Head, Shell Petroleum Co. Ltd. (*D. King Farlow ; H. Hyams.*)

STEPHENS, Frederick James, Manager, Production Dept., Anglo-Saxon Petroleum Co. Ltd. (*J. A. Oriel ; C. Hull.*)

TAYLOR, Charles George Brumby, Test Superintendent, Derby Corporation Omnibus Dept. (*A. W. Pottier ; P. E. B. Vaile.*)

WATSON, Robin Keir, Director, Associated Companies: Heat and Power Engineers Ltd., Clyde Tube Forgings Ltd. (*W. M. Cumming ; J. R. G. Barter.*)

WHEATLEY, Leonard Ernest, Assistant to Manager, Bitumen Dept., Shell Petroleum Co. Ltd. (*L. G. Gabriel ; H. Hyams.*)

WILD, Albert Edward, Sales Representative. (*R. W. E. Wilkinson ; T. M. Birchall.*)

WYLIE, Kenneth, Section Head, Production Dept., Anglo-Saxon Petroleum Co. Ltd. (*C. Hull ; H. Hyams.*)

YERNA, Jack Edmond, Technical Assistant, Anglo-American Oil Co. Ltd. (*K. Hunt ; R. B. Godfree.*)

Transfers.

BREWER, Charles Dunstan, Mechanical Engineer, "Shell" Refining & Marketing Co. Ltd. (*D. Morten ; N. Kendall.*) (*Member to Fellow.*)

GARNER-RICHARDS, Cecil Pooley, Junior Exploitation Engineer, Shell Petroleum Co. Ltd. (*R. L. Lyne ; S. E. Coomber*). (*Student to Associate Fellow.*)

GROFF, Jean Louis Eugene, Chief of Lubricants Dept., Institut du Petrole. (*Member to Fellow.*)

HAM, Albert John, Associate Director of Research, "Shell" Refining and Marketing Co. Ltd. (*D. Morten ; C. D. Brewer.*) (*Member to Fellow.*)

HICKS, Alexander Edward, Chemist, Commonwealth Oil Refineries Ltd. (*A. R. Comrie ; S. H. Evans.*) (*Associate Member to Associate Fellow.*)

STEET, William Robert, Production Oils Chemist, W. B. Dick & Co. Ltd. (*P. W. L. Gossling ; J. Romney.*) (*Associate Member to Associate Fellow.*)

SWISS, Michael, Shift Operator, Berry Wiggins & Co. Ltd. (*G. W. D. Holmes ; V. F. Cluer.*) (*Student to Associate Member/Fellow.*)

Corrections.

HARMAR-BROWN, F. M. S. In the *Journal* for May 1949 Mr. Harmar-Brown's designation was wrongly given. It should have read "An assistant to the Director of Public Relations for the M.O.P. Group of Companies and Petrochemicals Ltd." His proposer and seconder also should have been given as "E. J. Dunstan; G. Sell."

USHER, J. B. The name of Mr. Usher's employers was wrongly given in the July issue of the *Journal*. The correct name is Messrs. Williamson & Hogg Ltd.

ELECTION TO COUNCIL.

The attention of members of the Institute is directed to the following extracts from the By-Laws governing election to the Council of the Institute :—

> 72. *Each and every Corporate Member may nominate in writing a Corporate Member for election as a Member of Council. . . . A nomination to be valid must be signed by at least six other Corporate Members and must be received by the Secretary not later than the thirty-first day of December in any year. No member may sign more than one such Nomination Paper at any one election. . . . Nominations must be made on special forms obtainable from the General Secretary.*

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

OCTOBER 1949.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

BARRETT, William Thorpe, Acting Chief Chemist, Bahrein Petroleum Co. Ltd. (*N. E. Watson ; L. H. T. Walker.*)

ENDACOTT, Urquhart William Thomas, Assistant to General Manager, British Mexican Petroleum Co. Ltd. (*H. F. Jones ; W. G. Carder.*)

FULLER, Herbert Edwin, Lubricants Supervisor, Shell-Mex & B.P. Ltd. (*H. E. Priston ; G. E. Everist.*)

GOODING, William John, Divisional Lubricants Supervisor, Shell-Mex & B.P. Ltd. (*H. E. Priston ; G. E. Everist.*)

LANNUZEL, Jean, District Manager, Schlumberger Electrical Coring Methods (Trinidad). (*C. C. Wilson ; F. C. Hamilton.*)

MASSY, Charles Rochester, Joint Managing Director, Neal & Massy Engineering Co. Ltd. (*F. C. Hamilton ; C. C. Wilson.*)

MCCALL, Douglas, Fuel Oil Engineer, Anglo-American Oil Co. Ltd. (*W. Byrom ; C. Chilvers.*)

MORRIS, Ronald Charles, Engine Laboratory Supervisor, Regent Oil Co. Ltd. (*R. Sefton ; E. M. Tanner.*)

NORVAL, George Sturrock, Acting Assistant Pipeline Superintendent, Burmah Oil Co. Ltd. (*R. Nisbet ; T. J. H. Armstrong.*)

PALMER, Arthur Charles, Public Relations Manager, Anglo-American Oil Co. Ltd. (*C. Chilvers ; H. C. Tett.*)

SCOTT, James, Technical Assistant, Anglo-Iranian Oil Co. Ltd. (*L. W. Ford ; P. Wilson.*)

SHAW, James Henry, Company Representative, London Oil Refining Co. Ltd. (*J. E. M. Haslam ; G. Sell.*)

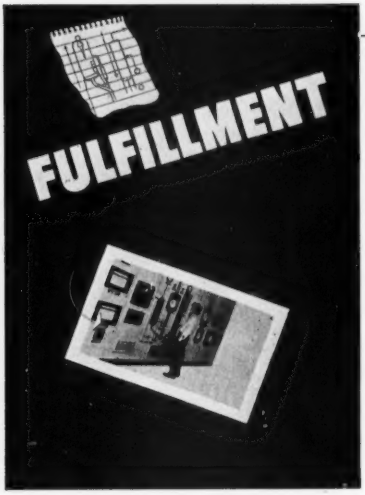
SOMMERVILLE, George Ferguson, Chemist, Trinidad Leaseholds Ltd. (*F. Morton ; R. Sefton.*)

WATKINS, Basil Hubert, Senior Technical Assistant, Research Dept., F. Perkins Ltd. (*A. Wilson ; C. D. Brewer.*)

Transfers.

BILTON, Norman Frederick, Research Chemist, Manchester University. (*L. Mills ; G. E. Everist.*) (*Student to Associate Fellow.*)

WESTBURY, John Henry George, Production Engineer, Trinidad Petroleum Development Co. Ltd. (*C. C. Wilson ; J. S. Collcott.*) (*Associate Member to Associate Fellow.*)



Fulfillment of contractual guarantees in plant design and construction is to be expected of any well qualified organization. It becomes a basis for preference as engineering commitments are consistently surpassed. Lummus stands ready for evaluation on whatever scale of values means the most to you: output, completion dates, or long initial runs. But the test that Lummus regards as the best evidence of its ability to fulfil your needs is its record of success in bringing new-process plants from pilot stage to full-scale operation.

FULFILLMENT –
(plant capacity)

A catalytic cracking plant, designed for 5400 B/D, was boosted to 6000 B/D on the 85th day of its initial run. Guaranteed percentage yield of high octane gasoline was also exceeded: 3070 B/D of 10-lb. RVP gasoline against a 2040 B/D guarantee.

FULFILLMENT –
(initial run)

A long initial run accurately forecasts long-term performance almost every time. This 10,000 B/D catalytic cracking plant was first shut down (for inspection) after 240 days on stream. No major maintenance was necessary. Total turnaround time was some 10,000 manhours.

FULFILLMENT –
(continuous output)

A continuous processing record for this customer—over 1,2000,00 barrels of crude—was established by this Lummus high-pressure cracking unit—on the line for 124 days.

FULFILLMENT –
(completion schedule)

A polyform gas reverison plant, designed to produce 4000 B/D of high octane gasoline, was completed on a tight 10-month schedule. The acceptance test run met all guarantees. The initial run continued 65 days before shutdown for employee-training purposes.

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420 Lexington Avenue, New York 17, N. Y.

LUMMUS

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designs and builds with

FULFILLMENT –

Teamwork Economy
Perspective Resourcefulness
Technique.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

NOVEMBER 1949.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

BEAVAN, D. A., student apprentice, Anglo-Iranian Oil Co. Ltd. (*P. F. Ellis ; E. J. Horley.*)

BIRRELL, Andrew Bruce, utilities engineer, " Shell " Refining & Marketing Co. Ltd. (*E. LeQ. Herbert ; H. Hyams.*)

BRUTON, Angus Stewart, assistant constructional engineer, National Oil Refineries Ltd. (*H. Murphy ; E. J. Horley.*)

CLARKE, Eric Hazlewood, engineer, Technical Dept., C. C. Wakefield & Co. Ltd. (*G. H. Thornley ; L. G. Packham.*)

COUPE, Bertram Chadwick, senior engine operator, " Shell " Refining & Marketing Co. Ltd. (*C. D. Brewer ; N. Kendall.*)

CROFT, Roy, chief chemist, Henry Prichard & Co. Ltd. (*P. W. L. Gossling ; N. E. F. Hitchcock.*)

EVANS, David Meurig, student apprentice, Anglo-Iranian Oil Co. Ltd. (*P. F. Ellis ; E. J. Horley.*)

GAUL, Richard John, oilfield sales engineer, Neal and Massy Engineering Co. Ltd. (*A. S. Curlet ; H. W. Reid.*)

GUNTHER, Albert Everard, Public Relations Dept., Shell Petroleum Co. Ltd. (*T. C. Owtram ; O. F. Thompson.*)

HOLMES, Stanley Edgar, chemist, Messrs. C. C. Wakefield & Co. Ltd. (*E. A. Evans ; G. H. Thornley.*)

LADE, John Mourier, co-ordinator, British Mexican Petroleum Co. Ltd. (*H. F. Jones ; W. G. Carder.*)

MORGAN, Christopher Ralph, production trainee, Trinidad Leaseholds Ltd. (*A. S. Curlet ; R. I. Martin.*)

MORRIS, Richard, civil engineer, Trinidad Leaseholds Ltd. (*H. Macnaughton-Jones ; A. Howe.*)

MUSGRAVE, Forrest Fairbrother, managing director, Anglamol Ltd. (*A. E. Hope ; A. W. Pepper.*)

PATE, Wilfred, production and field superintendent, Anglo-Iranian Oil Co. Ltd. (*W. J. Baker ; M. M. Pennell.*)

PRITCHARD, Ifor Thomas, student apprentice, Anglo-Iranian Oil Co. Ltd. (*P. F. Ellis ; E. J. Horley.*)

ROSENBERG, David John, cost accountant, Apex (Trinidad) Oilfields Ltd. (*A. Richard ; H. C. Costelloe.*)

RUSSELL, John Murdie, equipment engineer (drilling and production), United British Oilfields Ltd. (*F. C. Hamilton ; J. B. Key.*)

SHEAHAN, Thomas Henry Kennedy, technical officer, Shell Co. of Australia Ltd. (*R. H. Street ; H. A. Banks.*)

SWEATMAN, Arthur Hastings, petroleum engineer, Anglo-Iranian Oil Co. Ltd. (*W. J. Baker ; M. M. Pennell.*)

THOMS, Bernard Hunter Jameson, technical adviser, Shell-Mex and B.P. Ltd. (*W. S. Ault ; F. L. Garton.*)

WALKER, Stanley Thomas, engineering assistant, Anglo-Iranian Oil Co. Ltd. (*R. Stansfield ; J. J. Withers.*)

WHITE, Raymond Reginald, Petroleum Quality Officer, R.A.F. (*E. H. Jenkins ; P. F. Ellis.*)

WOOD, John Richard, student apprentice, Anglo-Iranian Oil Co. Ltd. (*P. F. Ellis ; E. J. Horley.*)

WRIGHT, John Joseph, terminal manager, Standard-Vacuum Oil Co. Ltd. (*M. T. Cowles ; G. Sell.*)

Transfers.

BALDWIN, Alan Henry, petroleum engineer, Ecuador Oilfields Ltd. (*C. C. Wilson ; J. S. Collcott.*) (*Associate Member to Associate Fellow.*)

COOPER, Arundel David, technical adviser, Shell Co. of Egypt Ltd. (*W. S. Ault ; J. Parrish.*) (*Member to Fellow.*)

HILL, William Albert, technical representative, C. C. Wakefield & Co. Ltd. (*G. H. Thornley ; J. C. Cragg.*) (*Associate Member to Associate Fellow.*)

MAPSTONE, George Edward, chief chemist, National Oil Pty. Ltd. (*T. G. Hunter ; P. Kerr.*) (*Member to Fellow.*)

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

Transferred from Members to Fellows.

BREWER, C. D. GROFF, J. L. E. HAM, A. J.

As Members.

CLARKE, J. H. GODBER, S. G. REID, G. L.
DAVIDSON, I. D. HOPKINS, J. G. STEPHENS, F. J.

As Associate Fellows.

GARNER-RICHARDS, C. P. MACLEOD-CAREY, C. R. A. STEET, W. R.
HICKS, A. E. PEBERDY, E. F. W. TAYLOR, C. G. B.
KNOX, A. M. RATCLIFFE, W. F. TAYLOR, H.

Transferred from Associate Member to Associate Fellow.

HICKS, A. E.

Transferred from Student to Associate Fellow.

GARNER-RICHARDS, C. P.

As Associate Members.

BARKER, R. G. GLERUM, M. J. RIPPINGGALE, F. L.
BATEMAN, E. L. GRANT, R. B. ROGERS, P. H. R.
BECKER, H. E. HOOK, C. C. SANSOM, F. E.
BOOTH, S. J. JEFFERSON, S. F. WATSON, R. K.
BROWN, C. C. NAYLOR, C. H. WHEATLEY, L. E.
BUSCOMBE, J. PAMPLIN, G. E. WYLIE, K.
CATTRALL, W. PICKETT, H. L. R. YERNA, J. E.
CHAPMAN, C. K. PUMMELL, H. J.

As Student.

RAY, B. N.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

DECEMBER 1949.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

ALLAN, Robert, chief chemist & works manager, R. D. Nicol & Co. Ltd. (*G. M. Davies ; E. R. Wilson.*)

BRITTAIN, Ernest William, assistant engineer, County Surveyors Dept., Cheshire. (*A. W. Attwooll ; C. G. Smith.*)

BROOKS, George Ernest, assistant installation manager, Shell Mex & B.P. Ltd. (*A. H. Stephenson ; G. H. Thacker.*)

CAMPBELL, Daniel David, assistant to costs operations manager, Anglo-American Oil Co. Ltd. (*E. Choppen ; G. M. Davies.*)

CUNNAH, Edward, managing director, Falcon Oil Co. Ltd. (*E. R. Wilson ; G. M. Davies.*)

DARLOW, Alexander, manager, Industrial Solvents Dept., Redline-Glico Ltd. (*C. R. Baker ; R. D. Streeton.*)

DAVIES, Arthur, fuel oil supervisor, Shell-Mex & B. P. Ltd.

GLYNN, Francis Joseph, plant operator, Petrochemicals Ltd. (*L. Jeffreys ; G. Sell.*)

GROSS, Nicholas, student, University of Birmingham. (*F. H. Garner ; F. Morton.*)

HALL, Fred, works chemist, H. G. Allcard & Co. Ltd. (*H. G. Allcard ; G. M. Davies*).

HARRIS, Eric Victor, clerk, John Hudson & Co. Ltd. (*W. J. Crafter ; A. Jackson.*)

HARRIS, William Richard, production supervising chemist, Distillers Co. (Biochemicals), Ltd.

HARVEY, Charles William, resident engineer, Anglo-American Oil Co. Ltd. (*K. Parsonage ; I. McCallum.*)

JEFFERS, John Edward Michael, technical assistant, Anglo-American Oil Co. Ltd. (*I. McCallum ; A. W. Pearce.*)

KEEL, Charles Leonard, head controlman (fluid catalyst cracking unit), Bahrein Petroleum Co. Ltd. (*A. F. Pyrah ; C. Simkins.*)

KRISHNAMURTHI, C. R., assistant-in-charge, lubricants section, Madras Laboratory (Fuel Testing).

MCCALMAN, Peter Hugh, student, University of Birmingham. (*F. H. Garner ; George Sell.*)

MACDONALD, Ralph, technical director, Falcon Oil Co. Ltd. (*E. R. Wilson ; G. M. Davies.*)

NIEL, William Hardwick, refinery cost accountant, Anglo-American Oil Co. Ltd. (*G. Noble ; F. Mayo.*)

OWEN, Henry Ernest Richard, installation engineer, Burmah-Shell Oil Storage & Distributing Co. of India Ltd. (*E. J. Sturgess ; R. L. Sarjeant.*)

PARKS, Norman Edward, engineer-in-charge of new construction and maintenance, Shell Co. of S. A. Ltd. (*R. Paget.*)

RACE, Russell, Edgar, chemist and metallurgist, Hoffmann Glos. Ltd. and Hoffmann Tweedales Ltd. (*G. Murray ; H. E. Priston.*)

ROMAN, Wadim, chief analyst, Petrocarbon Ltd. (*E. J. Dunstan ; W. E. Huggett.*)

SMETHURST, Noel Brian, acting head of process control dept. Anglo-American Oil Co. Ltd. (*I. McCallum ; A. W. Pearce.*)

SPEAR, Peter, senior research assistant, B.S.A. Group Machinability Res. Lab. (*D. A. Oliver ; E. C. Fleming.*)

TOWNEND, Peter Vincent, Regular Officer, Royal Army Service Corps. (*K. Beauchamp ; P. F. Ellis.*)

WHITE, Norman Arthur, research engineer, British Overseas Airways Corporation. (*C. S. Williams ; C. D. Brewer.*)

WINSCOMBE, James Everard, assistant manager, Eng. & Installation Dc Shell-Mex & B.P. Ltd. (*A. H. Stephenson ; F. N. Harrap.*)

Transfers.

BLACKMORE, David Stuart, technical sales representative, Shell Co. of W. A. Ltd. (*R. J. Smith ; G. H. Thacker.*) (*Associate Member to Associate Fellow.*)

HOLDING, Alfred Edward, geologist, British Controlled Oilfields Ltd. (*S. E. Coomber ; G. D. Hobson.*) (*Student to Associate Fellow.*)

SCALLAN, John Frederick Pratt, petroleum technologist, "Shell" Refining & Marketing Co. Ltd. (*R. S. Teale ; N. H. Shaw.*) (*Associate Member to Associate Fellow.*)

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-Laws.

Elections are subject to confirmation in accordance with the By-Laws.

As Fellows.

LANNUZEL, J. SARJEANT, R. L. STIRLING, W. M.
LAWSON, A. E. STEWART, D.

Transferred from Member to Fellow.

MORRISON, J. A.

As Members.

KETZER, P. A. MASSY, C. R. OWTRAM, T. C.

As Associate Fellows.

BARRETT, W. T. MORRIS, R. C. SOMMERVILLE, G. F.
COPPENS, J. F. C. NORVAL, G. S. STOCKS, J. R.
DEPAUW, C. A. L. PARRY, J. A. WATKINS, B. H.
GREER, E. M. SCOTT, J.

Transferred from Associate Members to Associate Fellows.

CROOK, R. D. WESTBURY, J. H. G. WHIPP, R. H.
KENYON, A. T. F.

Transferred from Students to Associate Fellows.

BARANY, G. M. BILTON, N. F. OVER, J. R.

As Associate Members.

BROOK-HART, D. GOODING, W. J. SHAW, J. H.
ENDACOTT, U. W. T. GROCOTT, P. C. SWISS, M.
FULLER, H. E. POWELL, R. H. WILD, A. E.

As Students.

DOWNS, J. M. MONCRIEFF-YEATES, A. J.

As Member Companies.

ANGLO-AMERICAN OIL CO. LTD. VACUUM OIL CO. LTD.
BURMAH OIL CO. LTD. MESSRS. C. C. WAKEFIELD & CO. LTD.
SHELL PETROLEUM CO. LTD.

Correction.

BOESE, A. C. In the *Journal* for August 1949, Mr Boese was shown as being transferred from Student to Associate Member. This is incorrect, as Mr Boese was transferred to Associate Fellow.

JOURNAL OF

THE INSTITUTE OF PETROLEUM

FOUNDED 1913 + INCORPORATED 1914

Vol. 35 DECEMBER 1949 No. 312

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The Use of Solid Carbon Dioxide to Extinguish the Burning of Liquids.
By J. H. Burgoyne, L. L. Katan, and J. F. Richardson.

Some Practical Aspects of the Problem of Applying Foam to Large Tanks.
By E. Thornton.

Oil from Oil Shale—Experience in the United States.
By R. A. Cattell.

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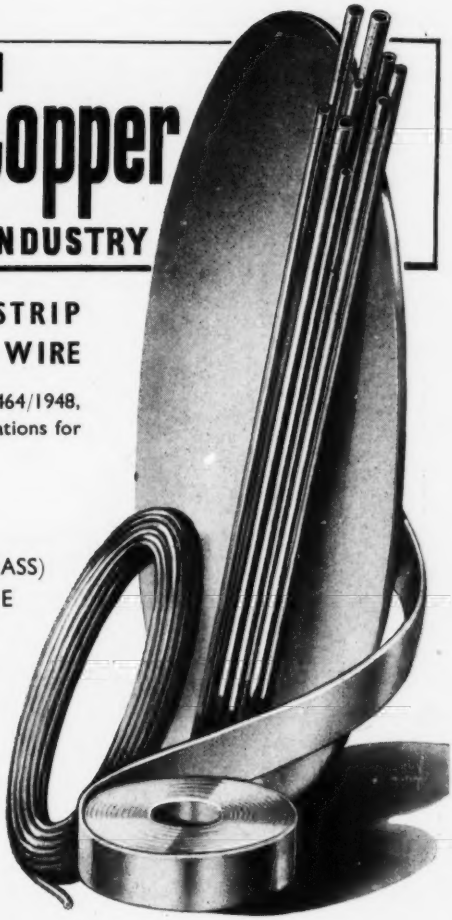

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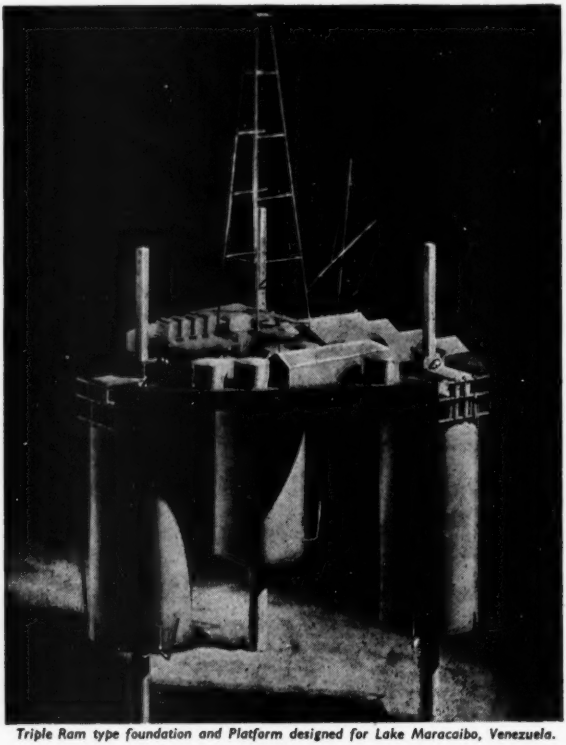

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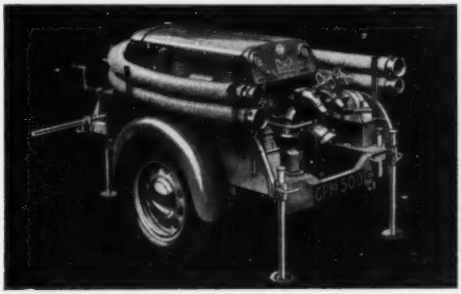

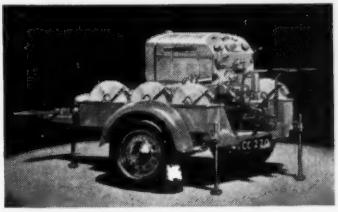

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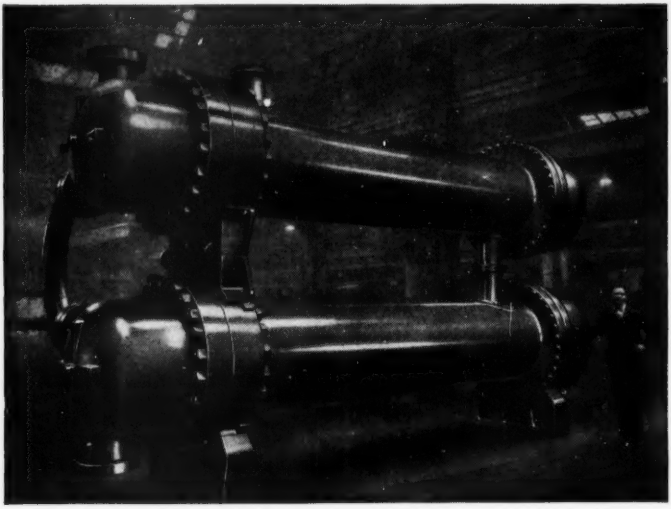

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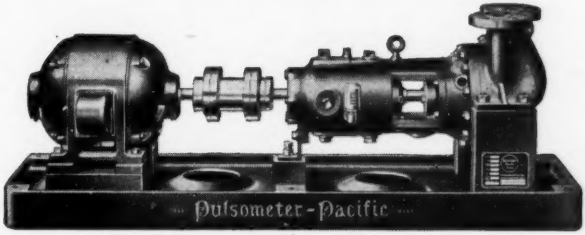

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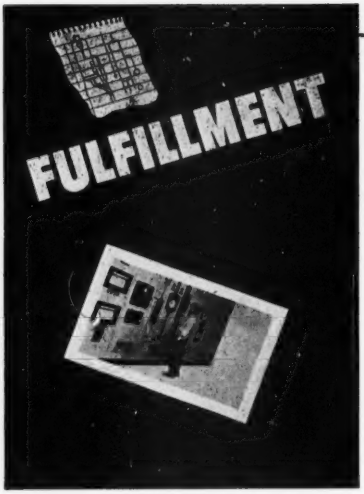

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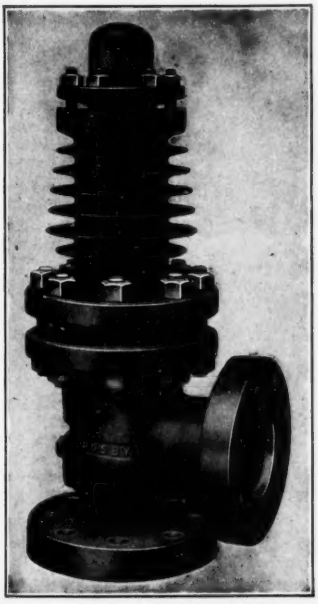

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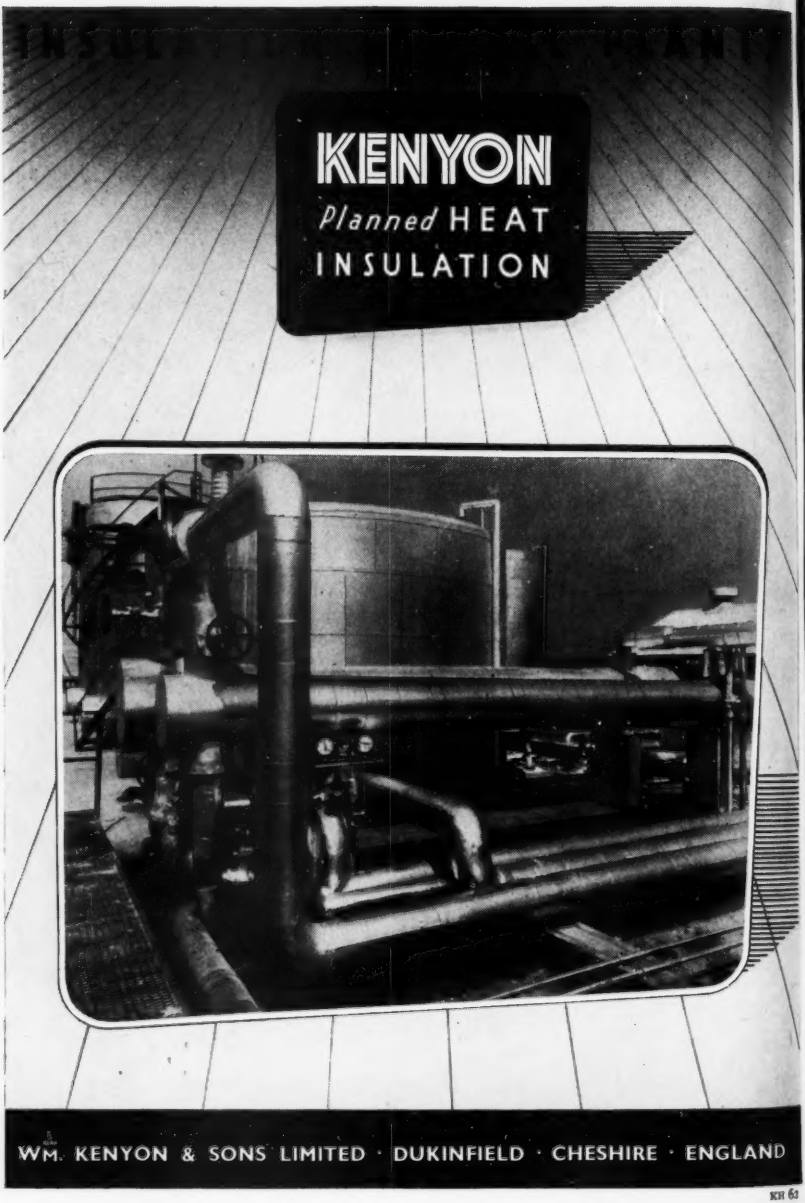

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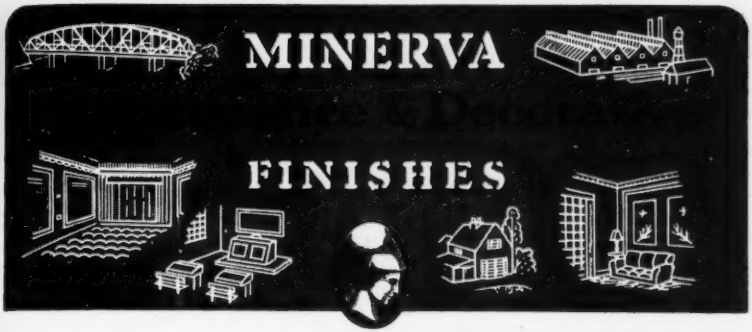

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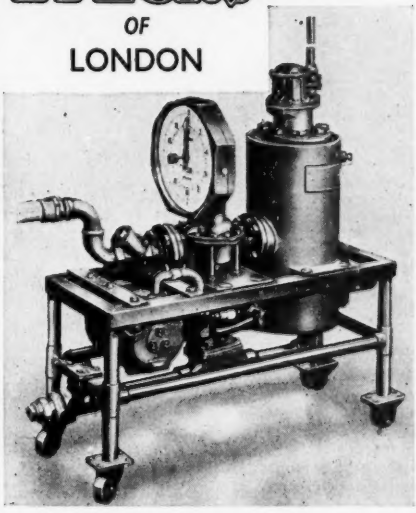

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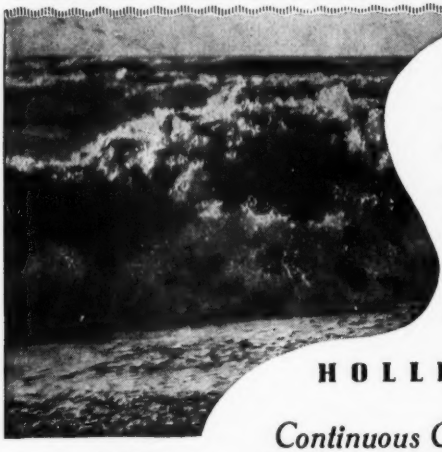

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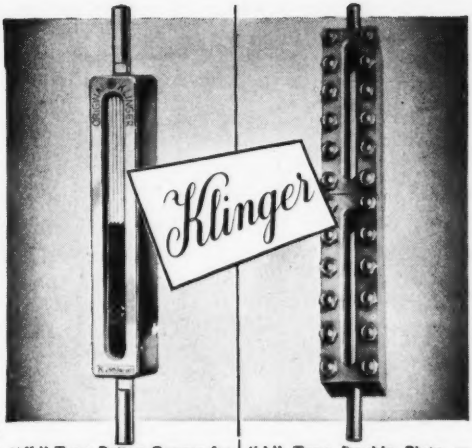

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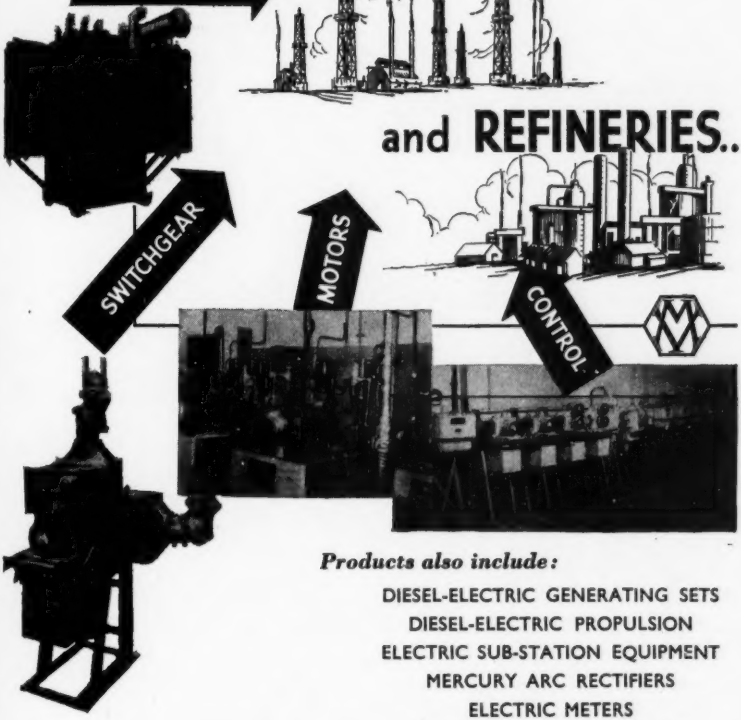

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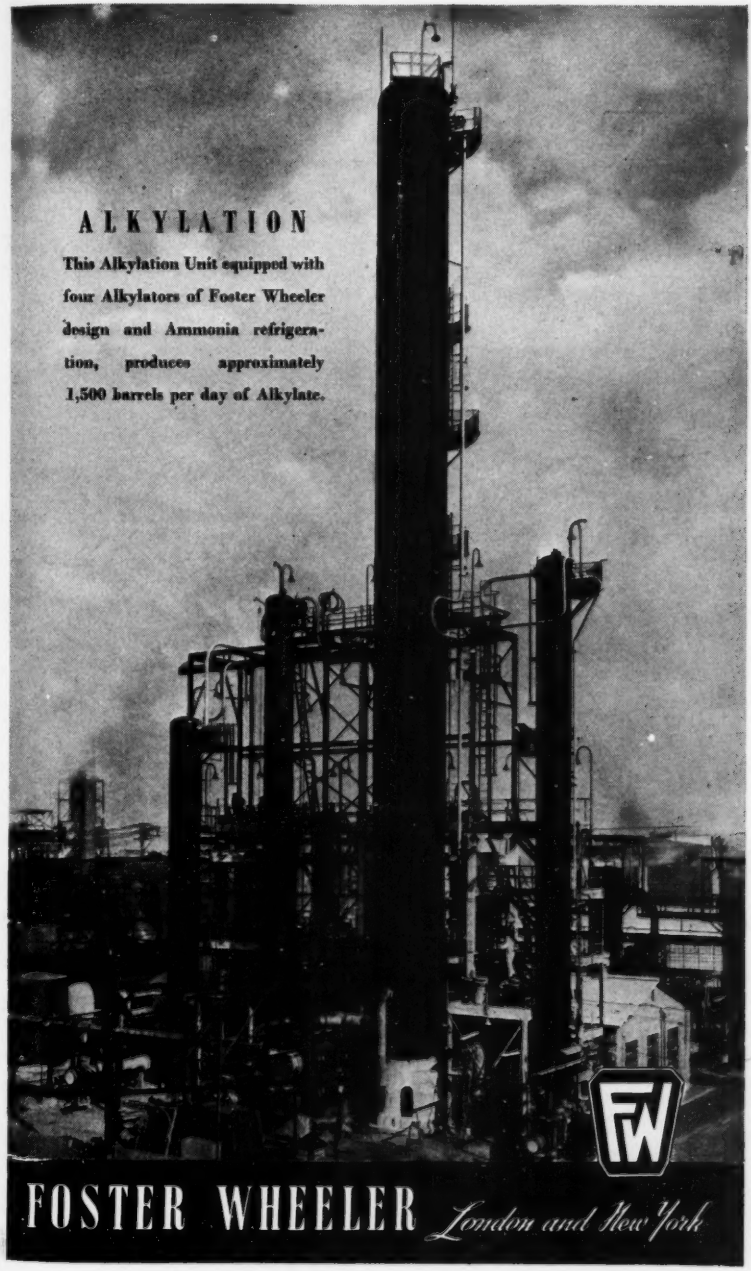
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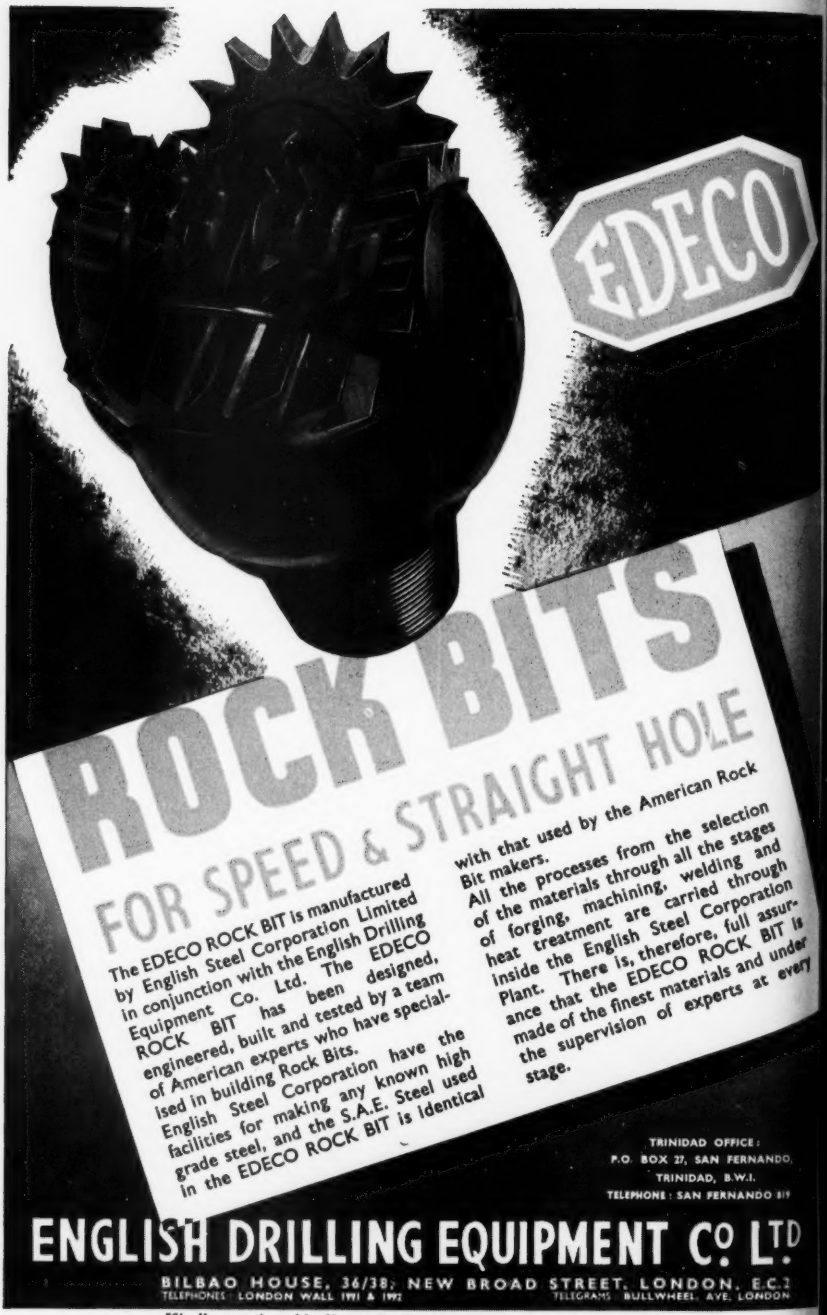
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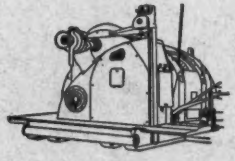
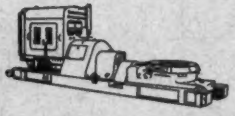
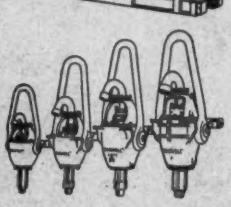


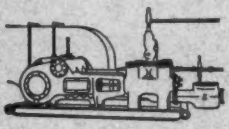
THE "OILWELL" NO. 96 RIG for deep drilling, and the "OILWELL" NO. 64-B RIG for medium depths, are outstanding in their class. A perfected and centralized system of air controls permits the speedy operation from the driller's position of all clutches and speed selections.



"OILWELL" ROTARY DRILLING UNITS are noted for their smooth operation and flexibility. They are available with two forward and one reverse gears. All "OILWELL" ROTARIES have the same general construction, and differ only in size and capacity.



"OILWELL" SWIVELS, recognized for their advanced design, have been used on many of the world's deepest wells. Four sizes, ranging from 100 to 400 tons capacity, provide a choice for any drilling requirement.



"OILWELL" PUMPS include a wide range of models suitable for every oil-field application. From the huge No. 220-P Power Slush Pump to the small No. 6P-HD for general service use, they embody construction features based upon time-proved design.

Whether you need a complete drilling rig or only a single item remember "OILWELL" is a good place to buy all your oil-field equipment and supplies.

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